City of Oneida Climate Action Plan 2014

Appendix A: Action Strategy Summary Document

Acknowledgements

The City of Oneida and Madison County wish to thank the following community members, organizations, and staff for their contributions to developing this Climate Action Plan.

City Staff
Jonathan Rauscher, City Engineer

Sustainability Plan Advisory Committee
Margaret Milman Barris, FPM Remediations and City resident
Alan Cohen, Utica Schools and City resident
Scott Ingmire, Madison County and City resident
David Wright, Oneida City School

CNY Regional Planning and Development Board
Chris Carrick, Energy Program Manager
Amanda Sopchak, Planner

Table of Contents

Acronyms Explained 4
Introduction 5
Background 5
Overview 5
The Purpose of this Document 6
City of Oneida Greenhouse Gas Reduction Target 7
Strategy Summary 7
Figures 8
Government Strategies 15
Transportation 15
1. Conversion to Hybrid Vehicles 15
2. Conversion to Electric Vehicles 17
3. Police on Bicycles 19
Buildings and Facilities 21
1. Energy Efficiency Retrofits of Existing Facilities 21
2. Install Solar PV Panels 23
3. Install Lighting Occupancy Sensors 25
4. Install Reflective Roofing 27
5. Institute a Power-Down at Night Policy 29
6. Information Item: Hydro-Power 31
Streetlights 32
7. Removal of City-Owned Ornamental Streetlights / Installing LED Streetlights 32
Water Delivery Facilities 35
1. Improve Water Pumping Energy Efficiency 35
Wastewater Treatment Facilities 37
1. Information Item: Using methane created during treatment process to power boiler system 37
Community Strategies 38
Transportation 38
1. Expand Bicycling Infrastructure 38

2. Increase Telecommuting 40
3. Construct Electric Vehicle Recharging Facilities 42
4. Conversion to Electric Vehicles 44
5. Improve/Expand Pedestrian Infrastructure 46
6. Conversion to Hybrid Vehicles 48
7. Increase Bus Ridership 50
8. Promote Carpooling/Vanpooling 52
Residential Energy Use 54
1. Promote Energy Efficiency through Campaign Targeted at Residents 54
2. Install Residential Solar PV Panels 56
3. Weatherization of Low-Income Housing 58
4. Geothermal Heat Pump 61
5. LED Light Bulbs 63
6. Promote Loans/Incentives for Energy Efficiency Improvements 65
Commercial Energy Use 68
1. Install Commercial Solar PV Panels 68
2. Promote Energy Efficiency through Campaign Targeted at Businesses 70
3. Install Lighting Occupancy Sensors 72
4. Institute a Power-Down at Night Policy 74
5. Energy Efficiency Retrofits of Existing Facilities 76
Waste 78
1. Encourage Organics (Kitchen) Composting 78
2. Encourage Yard Waste Composting 80
Natural Resources 82
1. Tree Planting for Carbon Storage and Energy Savings 82
Reduction Summaries 84
CAFE Standards Emissions Reduction Calculations 86

Acronyms Explained

Btu and MMBtu: British Thermal Units and Millions of British Thermal Units. A Btu is the amount of energy needed to cool or heat one pound of water by one degree Fahrenheit, and MMBtu represents 1 million Btu.

CAFE: Corporate Average Fuel Economy. CAFE standards have been set by the federal government for the years 2016 and 2025.

CAPPA: Climate and Air Pollution Planning Assistant. CAPPA is a tool provided by ICLEI – Local Governments for Sustainability to help local communities assess the effectiveness of certain emissions reduction strategies in their communities. CAPPA is the tool that was used for all of the calculations in this document.

DPW: Department of Public Works.

GHG: Greenhouse Gas

kW: Kilowatt. kW is a unit of power equal to 1,000 watts.

kWh: Kilowatt hour. A kilowatt-hour (symbolized kWh) is a unit of energy equivalent to one kilowatt (1 kW) of power expended for one hour (1 h) of time.

$MTCO_2e$: Metric Tons of Carbon Dioxide Equivalent. $MTCO_2e$ converts the warming potential of each greenhouse gas (i.e. carbon dioxide, nitrous oxide, methane, etc.) into one measurement.

NYSERDA: New York State Energy Research and Development Authority. NYSERDA is a public benefit corporation created in 1975. Its goal is to help New York meet its energy goals of reducing energy consumption, promoting the use of renewable energy sources, and protecting the environment. NYSERDA offers a variety of incentive programs to help New York residents achieve these goals.

PV: Photovoltaic. Solar PV systems convert sunlight directly into electricity.

VMT and DVMT: Vehicle Miles Traveled and Daily Vehicle Miles Traveled. Vehicle Miles Traveled (VMT) is the total number of miles driven by all vehicles within a given time period and geographic area. It is used by regional transportation and environmental agencies for planning purposes. VMT is influenced by factors such as population, age distribution, and the number of vehicles per household. However, the greatest factor by far is how land uses are arranged.

Introduction

Background

The City of Oneida began their participation in the Central New York Climate Change Innovation Program (C2IP) by adopting the Climate Smart Communities (CSC) pledge in the spring of 2014, pledging their commitment to energy and emissions reduction. The City received technical assistance from the Central New York Regional Planning and Development Board (CNY RPDB) and SUNY College of Environmental Science and Forestry (ESF) in the spring of 2014 to complete a greenhouse gas (GHG) inventory for the 2010 (baseline year) calendar year. The GHG inventory report was compiled to detail energy use and the sources of emissions in the City. The inventory provided the City with a better understanding of its contribution to carbon emissions, and also serves as a basis for the development of a targeted action plan for reducing GHG emissions over time.

The City received additional assistance through the C2IP program in cooperation with the CNY RPDB throughout the summer and fall of 2014 to begin to analyze potential strategies for reducing emissions. CNY RPDB staff worked to analyze potential strategies for reducing the City's emissions for both municipal operations as well as at a community-wide scale. CNY RPDB staff utilized a software tool developed by ICLEI-Local Governments for Sustainability known as CAPPA (Climate and Air Pollution Planning Assistant) version 1.5 to calculate potential GHG reductions as well as cost savings for each strategy. CAPPA is an Excel-based decision-support tool designed to help U.S. local governments explore and identify potential opportunities to reduce greenhouse gas emissions and other air pollution emissions. CAPPA provides a starting point for two major tasks: determining an achievable emissions reduction target and selecting strategies to include in a local government–operations or community-scale emissions-reduction plan, commonly called a climate action plan. CAPPA users can compare the relative benefits of a wide variety of emissions reduction and clean air measures, and identify those most likely to be successful for their community based on its priorities and constraints.

The action strategies explored in this document provide the City of Oneida with an estimate of potential reductions as well as costs and other co-benefits. By implementing the strategies noted in this document, the community will not only be able to reduce GHG emissions, but will also be able to reduce energy costs, decrease reliance on non-renewable, foreign sources of energy, and conserve Oneida's resources for the future.

Overview

Global concern with climate change is primarily focused on the amount of greenhouse gases in the atmosphere. Greenhouse gases, such as carbon dioxide, water vapor, and methane, among others, are an essential part of our atmosphere, and they serve a vital role in making our planet warm enough for life. Greenhouse gases trap energy (in the form of long wave radiation) that is

being emitted by the Earth, reflecting it back into the atmosphere to warm the planet. As the amount of carbon dioxide in the atmosphere has increased or decreased over time, the planet's temperature has changed in roughly the same proportion. Scientists have determined this relationship from studying ice cores taken from Antarctica from over 400,000 years ago. Right now there is more carbon dioxide in the atmosphere than at any time measured in the ice core.[i] Scientists expect that this will lead to a gradual warming of the planet in most areas.

Anthropogenic emissions of carbon dioxide and other greenhouse gases into the atmosphere are major contributors to global climate change. Therefore, it is imperative for municipalities around the world, including the City of Oneida, to take immediate action towards decreasing emissions.

The Purpose of this Document

The role of this document is to identify and analyze local actions that the City of Oneida can take to reduce greenhouse gas emissions caused by human activities occurring within the City. The document does not debate the issue of global climate change. In recent years, the scientific community has reached a nearly unanimous consensus that climate change is occurring, that human activities are a primary cause, and that the potential consequences could be severe. Climate scientists around the world, represented by the Intergovernmental Panel on Climate Change (IPCC), have an unequivocal position: human activity is changing the earth's climate through the release of GHG emissions resulting from the combustion of fossil fuels. The longer communities delay taking action, the greater the risk humans face of irreversibly depleting nonrenewable resources and harming our environment. This strategy summary document is designed to act as a blueprint for the community's response to the challenges posed by climate change.

The City of Oneida cannot solve the global climate crisis alone, but together with partners in county, state, and federal government, the City has committed to taking steps to reduce emissions and create new programs and services that will support the community and families in doing the same.

This document offers suggestions that can make homes more energy efficient and increase the amount of locally produced renewable energy. It explores strategies for reducing emissions from transportation. Finally, this document outlines measures that can make the City's municipal operations a model for efficiency and resource-conservation.

[i] In January 1998, the collaborative ice-drilling project between Russia, the United States, and France at the Russian Vostok station in East Antarctica yielded the deepest ice core ever recovered, reaching a depth of 3,623 m (Petit et al. 1997, 1999). The extension of the Vostok CO_2 record shows the present-day levels of CO_2 are unprecedented during the past 420 kyr. Pre-industrial Holocene levels (~280 ppmv) are found during all interglacials, with the highest values (~300 ppmv) found approximately 323 kyr BP.

City of Oneida Greenhouse Gas Reduction Target

Through the analysis of the strategies outlined in this document the City of Oneida has identified an emissions reduction target goal of 20% for municipal operations and 15% for the community, representing a total of 16,496 metric tons of CO_2 reduced by 2025.

Strategy Summary

GHGs are gases in Earth's atmosphere that prevent heat from escaping into space. GHG emissions are typically associated with the burning of fossil fuels, such as coal and oil, and are classified into scopes.

- Scope 1 emissions are direct GHG emissions from sources that are owned or controlled by the entity. Scope 1 can include emissions from fossil fuels burned on site, emissions from entity-owned or entity-leased vehicles, and other direct sources.
- Scope 2 emissions are indirect GHG emissions resulting from the generation of electricity, heating and cooling, or steam generated off site but purchased by the entity, and the transmission and distribution (T&D) losses associated with some purchased utilities (e.g., chilled water, steam, and high temperature hot water).[1]
- Scope 3 emissions include indirect GHG emissions from sources not owned or directly controlled by the entity but related to the entity's activities. Scope 3 GHG emission sources that are typically quantified include T&D losses associated with purchased electricity, employee travel and commuting, contracted solid waste disposal, and contracted wastewater treatment. Additional sources may include GHG emissions from leased space, vendor supply chains, outsourced activities, and site remediation activities.[ii]

Utilizing CAPPA, a variety of strategies were identified and analyzed to determine their potential for achieving emissions reductions either at the municipal operations level or the community scale. The analysis team also explored the potential impacts of an external large scale factor on the City's emissions profile: New Federal CAFE Standards that will increase the average fuel economy of vehicles sold in the U.S. through 2025. The results of these analyses are summarized in the tables below. In most cases, if there were multiple potential strategies addressing a singular target area (e.g. vehicle fuel sources: electric, diesel, hybrid, natural gas), the strategy that was the most cost effective with the largest emissions reduction impact was chosen to be included in the final summary.

[ii] http://www.epa.gov/oaintrnt/ghg/ Greening EPA

Figures

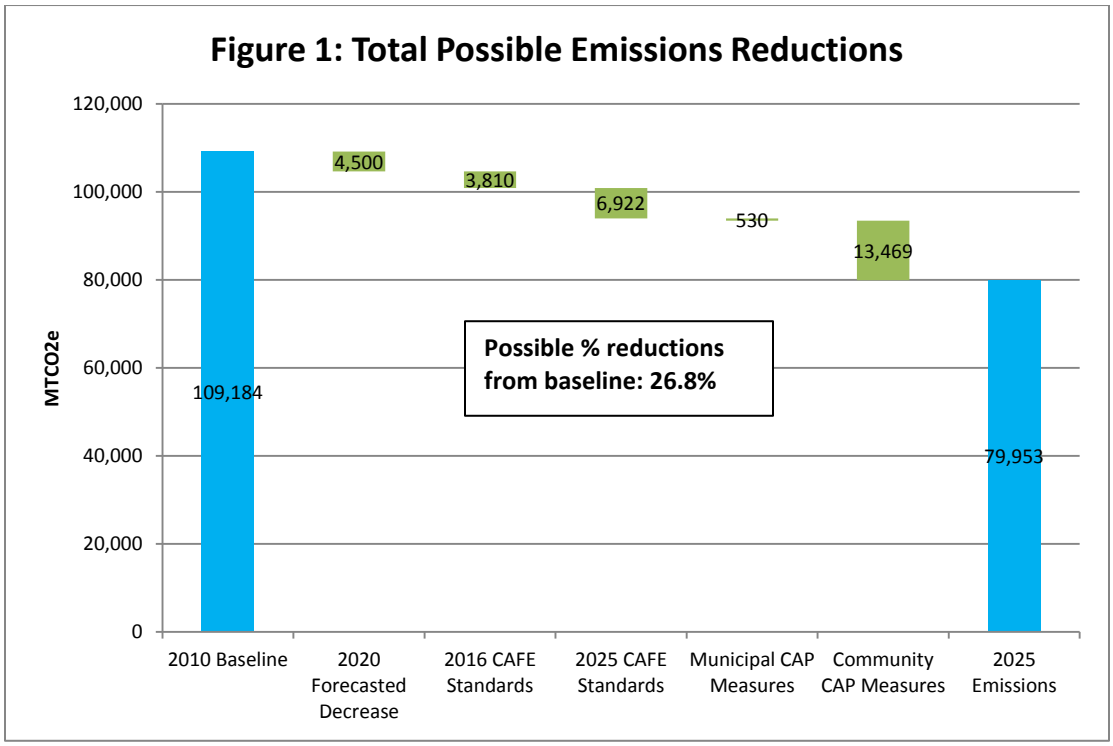


Figure 1 summarizes the results of the City's GHG inventory, a 2020 emissions forecast based on current trends, impacts from the strengthening of Federal CAFE standards, as well as the reductions associated with the Climate Action Strategies that were analyzed for the City separated into community-wide measures as well as municipal operations measures. It is projected that Oneida's total GHG emissions in 2025 could be reduced by 26.8% if the City implements all of the recommended community-wide and municipal operations measures.

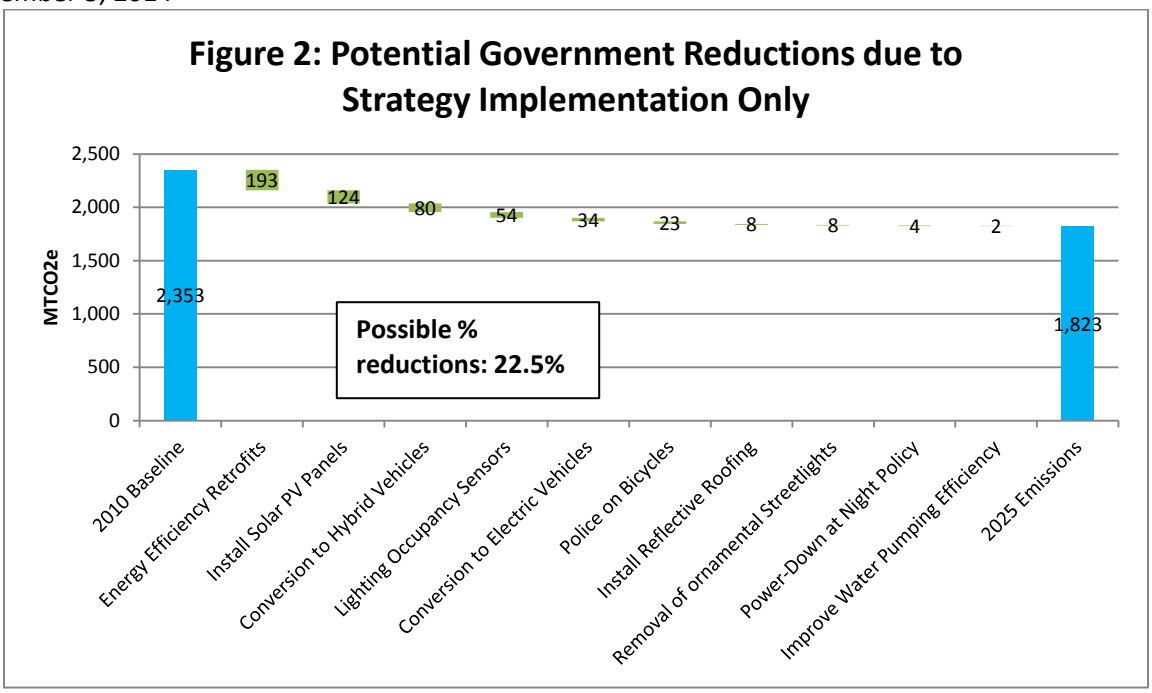
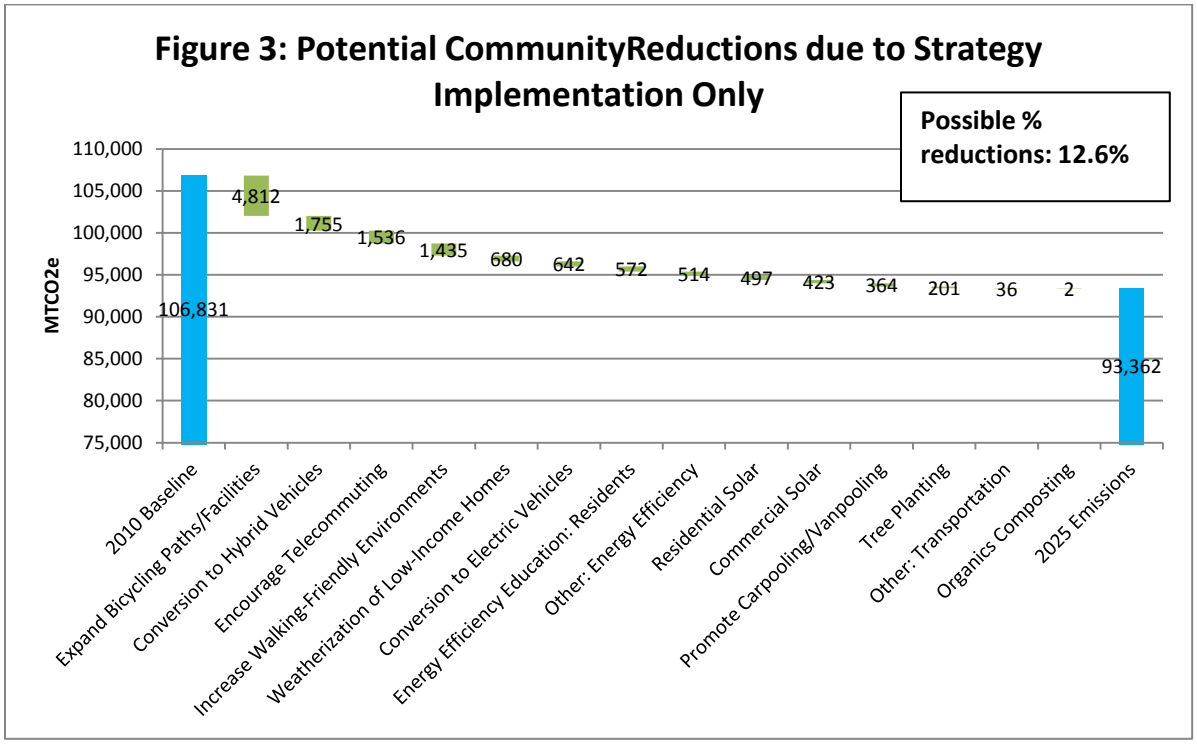


Figure 2 depicts the City of Oneida's 2010 baseline municipal emissions as recorded by the GHG inventory report, potential reductions due to suggested strategies, and potential emissions in 2025 should each of the suggested strategies be implemented. It is estimated that there will be a 22.5% reduction in community emissions if all suggested strategies are implemented.



*Other: Energy Efficiency includes: weatherization of low-income homes, geothermal heat pump, CFL bulb distribution, loans for energy efficiency retrofits, energy efficiency education: businesses, power-down at night

policy, lighting occupancy sensors, and commercial retrofits to existing facilities. Other: Transportation includes: electric vehicle charging facilities, and increase bus ridership.

Figure 3 depicts the City of Oneida's 2010 baseline community emissions as recorded by the GHG inventory report, potential reductions due to suggested strategies, and potential emissions in 2025 should each of the suggested strategies be implemented. It is estimated that there will be a 12.6% reduction in community emissions if all suggested strategies are implemented.

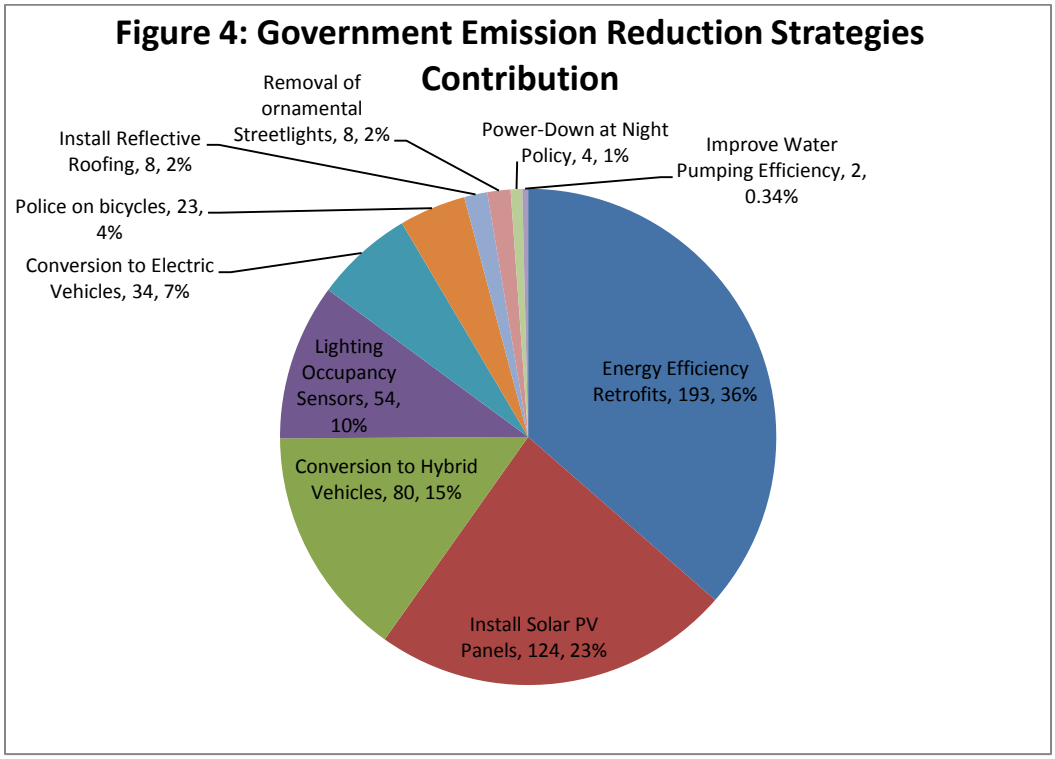


Figure 4 depicts each of the suggested municipal reduction strategies and their contribution to overall municipal emissions reductions.

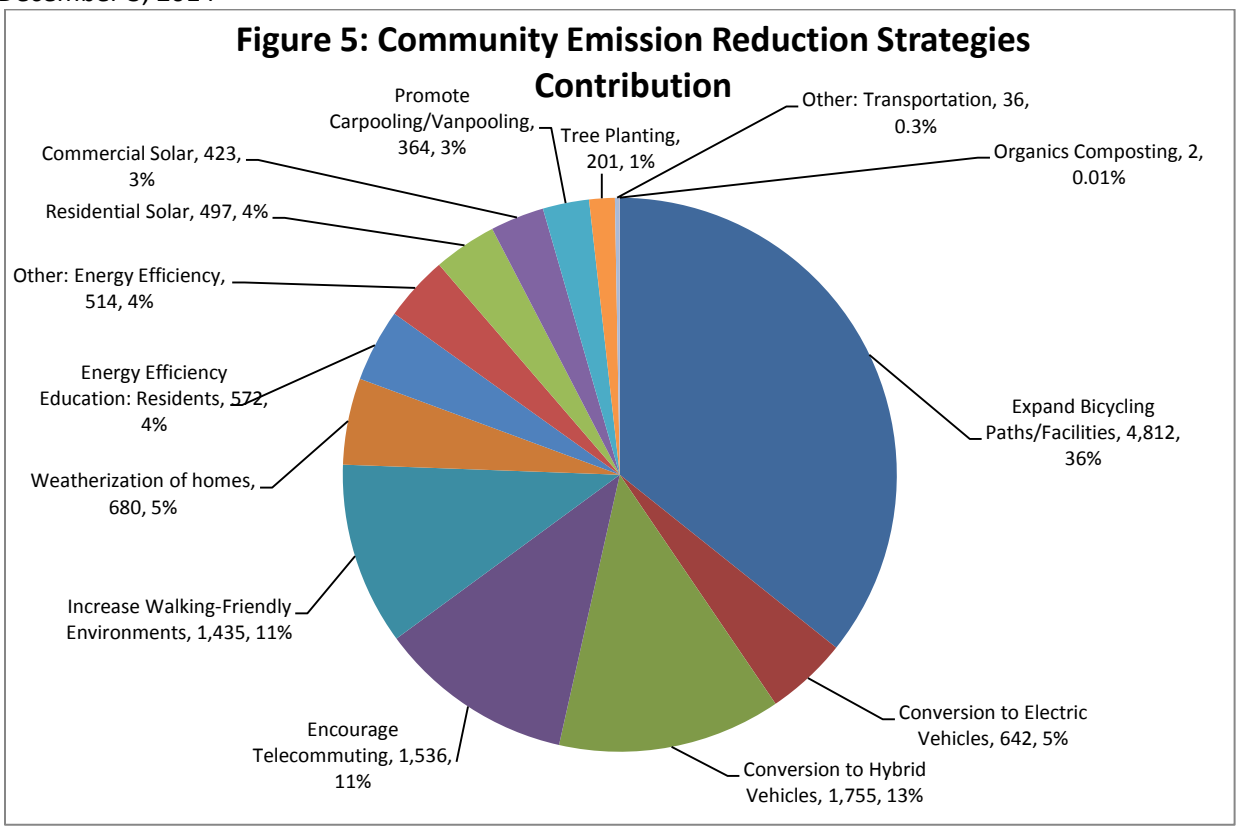


Figure 5 depicts each of the suggested community reduction strategies and their contribution to overall municipal emissions reductions.

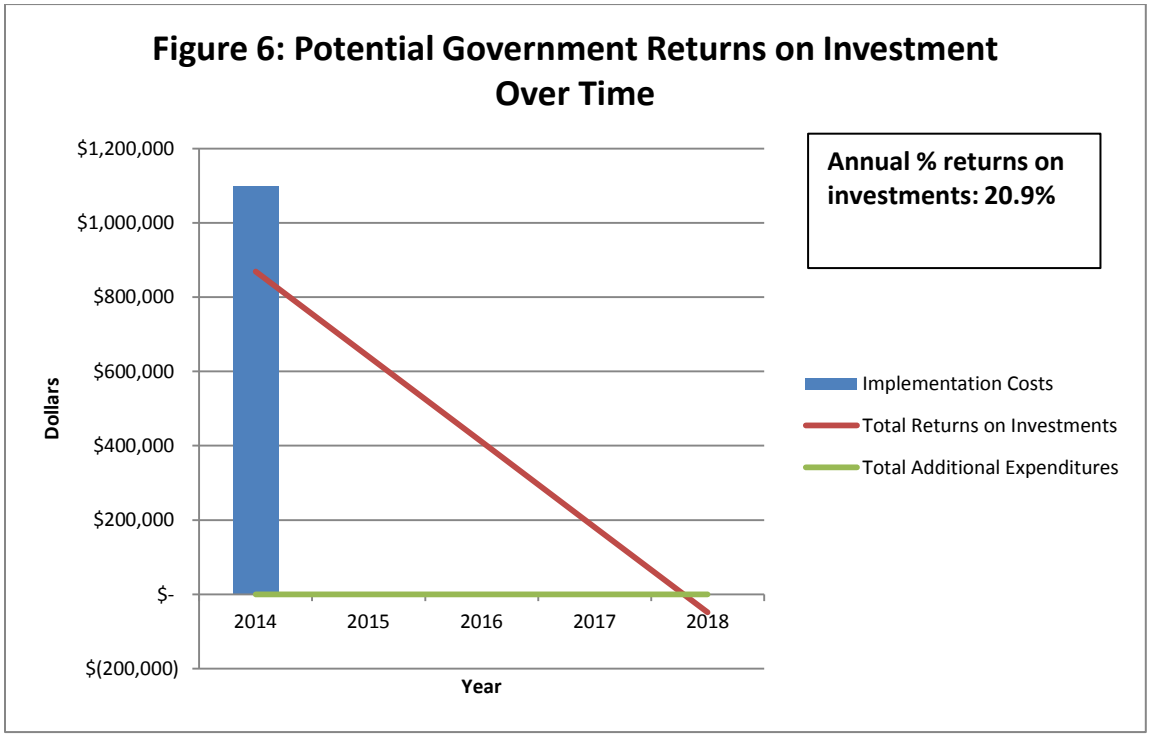


Figure 6 depicts the total implementation cost of all suggested municipal emissions reduction strategies and their annual returns on investment. It also shows additional expenditures that would be incurred due to strategy implementation. It is estimated that the annual return on investments for all of the suggested municipal emissions reduction strategies is approximately 20.9%.

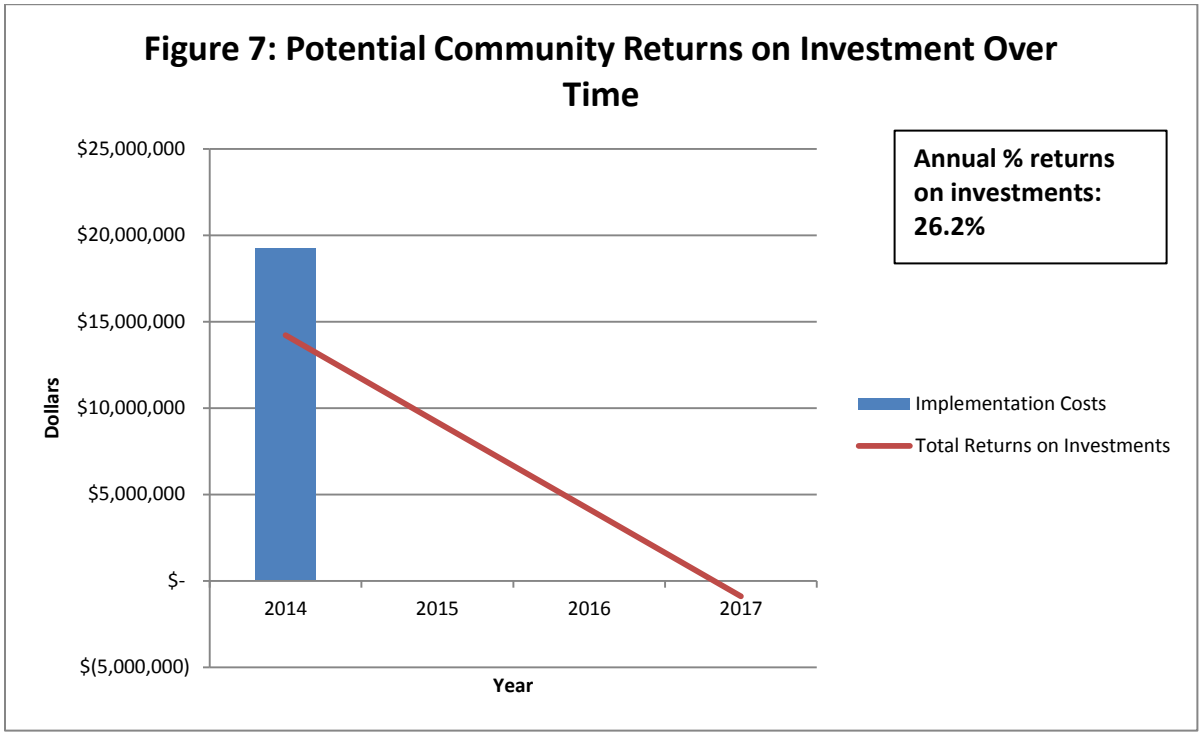


Figure 7 depicts the total implementation cost of all suggested community emissions reduction strategies and their annual returns on investment. It also shows additional expenditures that would be incurred due to strategy implementation. It is estimated that the annual return on investments for all of the suggested emissions reduction strategies is approximately 26.2%.

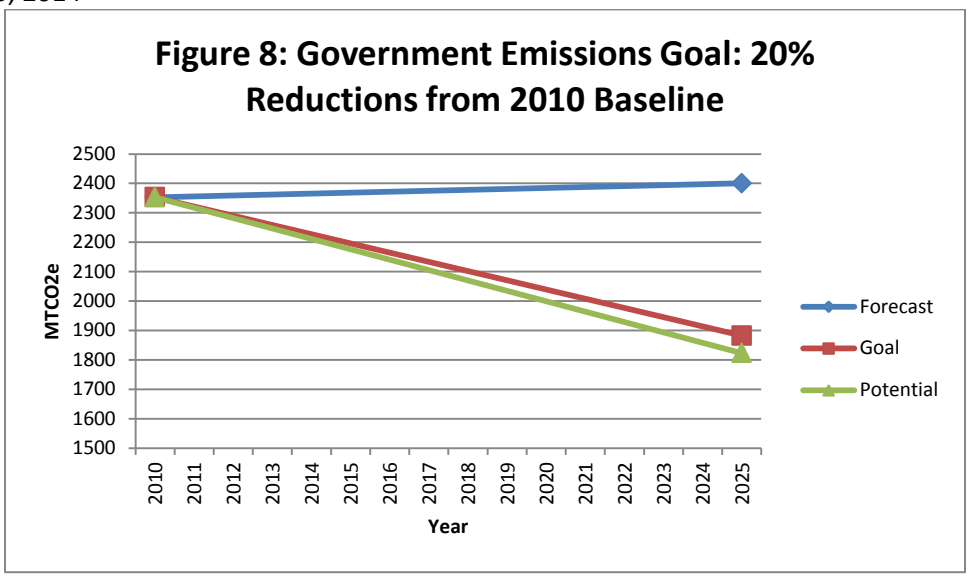


Figure 8 depicts forecasted emissions for the City of Oneida in the year 2025 if no action is taken, emissions if a 20% government reduction goal is reached, and the emissions potential if all the suggested strategies are adopted.

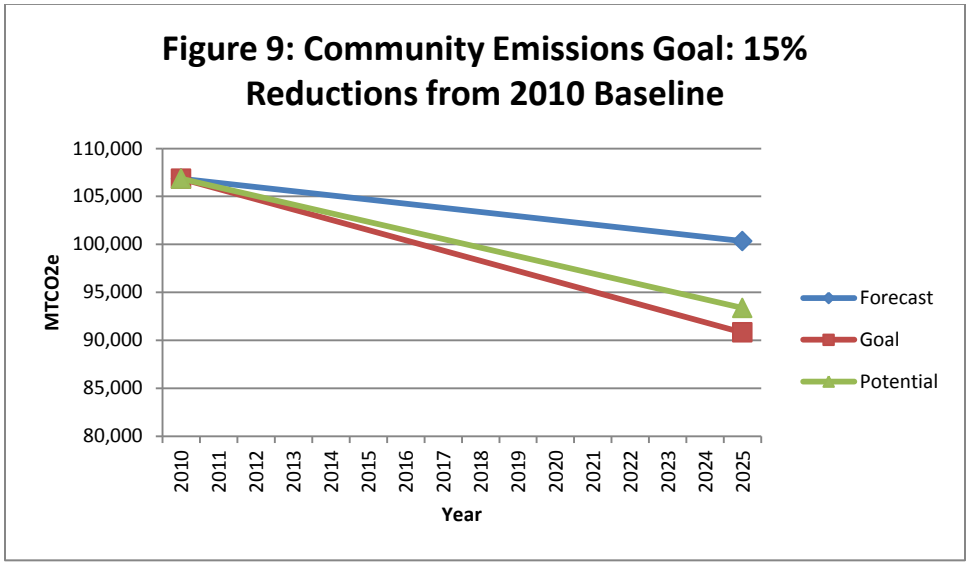


Figure 9 depicts forecasted emissions for the City of Oneida in the year 2025 if no action is taken, emissions if a 15% community reduction goal is reached, and the emissions potential if all the suggested strategies are adopted.

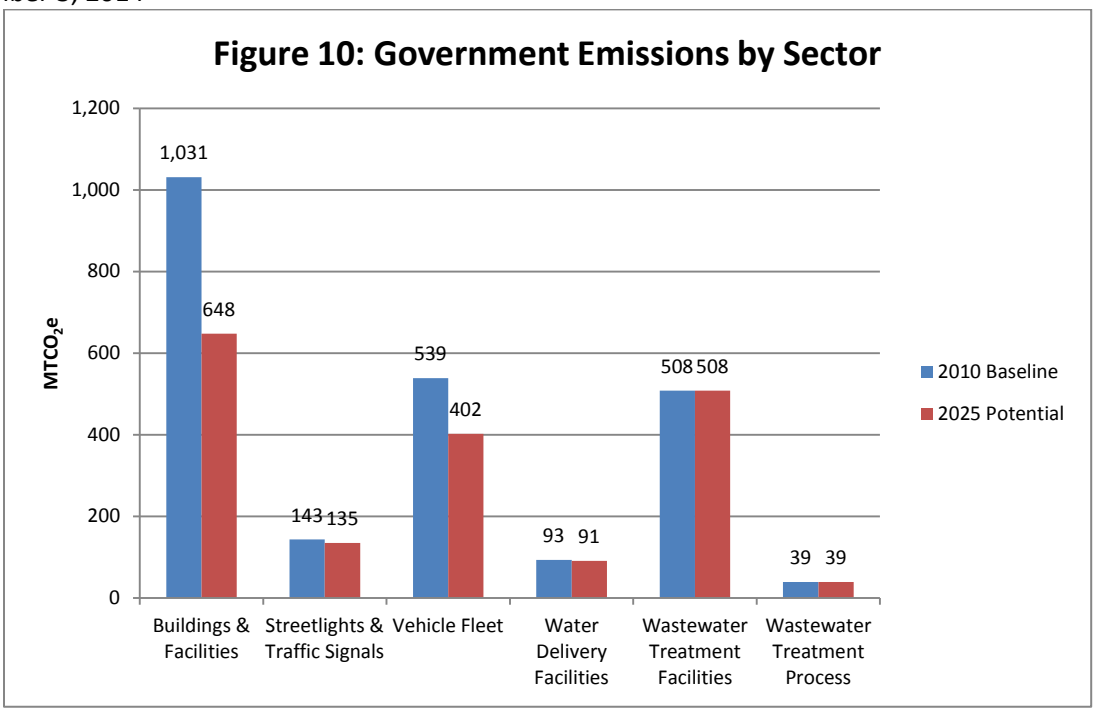


Figure 10 compares the municipal emissions per sector in the 2010 base year and 2025 emissions potentials if each of the suggested strategies is implemented.

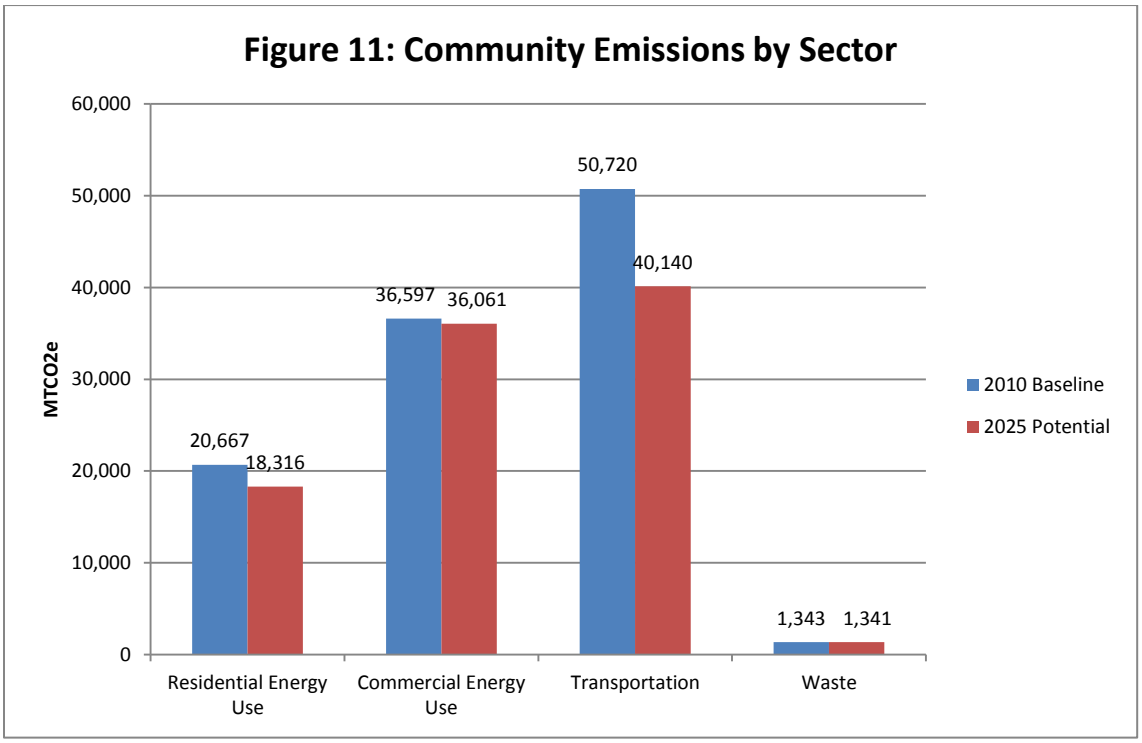


Figure 11 compares the community emissions per sector in the 2010 base year and 2025 emissions potentials if each of the suggested strategies is implemented.

Government Strategies

Transportation

1. Conversion to Hybrid Vehicles

Strategy Description:
Hybrid/electric vehicles couple an electric drive with a gasoline engine and are widely available and are suited for a variety of applications. Hybrid vehicles are being used as taxi cabs in New York City and San Francisco. In 2006, Ford Motor Company pledged to make hybrid versions of half of their fleet, and automakers are increasingly making hybrid/electric versions of existing models.

Hybrids are less expensive to operate than regular vehicles, and while key issues related to battery life still remain, maintenance and fuel savings costs are expected to outweigh the price of battery replacement.

The Oneida City police fleet contains the majority of passenger vehicles utilized by the City and would be most affected by implementing this strategy.

- **Methodology**
  - Number of hybrids
    - 13 passenger vehicles used by the City[1], assume rest of vehicles make the switch (those that did not convert to electric vehicles) = 10 vehicles
  - Price of gasoline
    - $3.30[2]
  - MPG of vehicles replaced
    - 13.6[3]
  - Average annual miles per vehicle
    - 16,372 miles[4]
  - Hybrid MPG
    - 46-55 MPG hybrid cars[5]
    - Assume 46 MPG
  - Incremental cost of hybrid vehicle
    - Toyota Prius Two base 2013 = MSRP $24,960[6]
    - Toyota Camry base 2013 = MSRP $23,030
    - $24,960 - $23,030 = $1,930

10	Number of Hybrids Used

$3.30	Price of Gasoline ($ per gallon)
46	Hybrid Miles per Gallon
13.6	Miles per Gallon of Vehicle Replaced

16,372	Average Annual Miles per Vehicle
$1,930	Incremental Cost of Hybrid
8,479	Annual Gasoline Savings (gallons)
$27,981	Annual Cost Savings
0.7	Simple Payback (years)[iii]

CO2e (metric tons)
80

Co-Benefits	Success Stories
- Reduces local air pollution -Less expensive to operate than regular vehicles -Reduces reliance on foreign oil	-Rockland County initiated the greening of its municipal fleet with Local Law 4 of 2006, which included a timeline for converting the entire fleet to hybrids or alternative fuel vehicles by 2010.[7] -NYSERDA provides financial assistance and technical information to encourage fleets to purchase alternative fuel vehicles and install fueling facilities or charging stations. Certain hybrid-electric vehicles are eligible under many of the programs NYSERDA offers. [8] -Houston's light duty passenger fleet has become over 50% hybrid, making it the 3rd largest municipal hybrid fleet in the US[9].

[iii] Note: This calculation does not include maintenance costs.

2. Conversion to Electric Vehicles

Strategy Description:
Electric vehicle charging stations are an effective way to promote and incentivize electric vehicle usage. Because electric vehicles require electricity to operate instead of fossil fuels, emissions from transportation have the potential to decrease if electric vehicle charging stations are implemented. In 2013, NYS Governor Andrew Cuomo announced the Charge NY program which calls for investment in 3,000 public and workplace charging stations by 2018. NYS expects the number of EVs to increase to as many as 40,000 by 2018, and a million by 2025. The NYS Cleaner Greener Communities program has also made up to $1 million available for communities to adopt streamlined permitting and other ordinances for electric vehicle charging stations, funding is available in the amount of $2,500 per project for applicants representing a population of up to 30,000 residents.

- **Methodology**
  - Number of vehicles switching
    - 13 passenger vehicles used by the City[10], assume 3 make the switch (2 codes vehicles, fire chief or water super)
  - Price of gasoline
    - $3.30[11]
  - Price of electricity ($ per kWh)
    - $0.122 per kWh[12]
  - MPG of vehicles replaced
    - 13.6[13]
  - Average annual miles per vehicle
    - 16,372 miles[14]
  - Incremental cost of electric vehicle vehicle
    - Nissan Leaf base 2013 = MSRP $35,690
    - Toyota Camry base 2013 = MSRP $23,030
    - $35,690 - $23,030 = $12,660
    - Plus a Federal tax credit up to $7,500 of Nissan Leafs purchased in or after 2010; $12,660 - $7,500 = $5,160

3	Number of Electric Vehicles

$3.30	Price of Gasoline ($ per gallon)
$ 0.1220	Price of Electricity ($ per kWh)
13.6	Miles per Gallon of Vehicle Replaced
16,372	Average Annual Miles per Vehicle
$5,160	Incremental Cost of Electric Vehicle
3,611	Annual Gasoline Savings (gallons)
18	Annual Electricity Use (kWh)
$11,916	Annual Cost Savings

1.3	Simple Payback (years)[iv]

CO2e (metric tons)
34

Co-Benefits	Success Stories
-Reduces local air pollution -Lower operating cost than gasoline vehicles Installation of Blink electric car charging station in Syracuse, NY	-Governor Cuomo announced on April 11, 2013 that more than 360 electric vehicle and plug-in hybrid charging stations will be installed across the state in support of his Charge NY initiative, which is an initiative to create a statewide network of up to 3,000 public and workplace charging stations over the next five years and to put up to 40,000 plug-in vehicles on the road during that period.[15] -The Kanagawa Prefecture in Japan is the most successful electric vehicle region in the world, with 2,183 registered electric vehicles. In the US, citizens of cities like Los Angeles (2,000 registered electric vehicles), Portland (1,300 registered electric vehicles), New York City (238 registered electric vehicles), and Research Triangle, NC (134 registered electric vehicles) have begun to realize the benefits of electric vehicles as well[16]. -California offers several types of incentives to encourage drivers to make the switch to electric vehicles. The California Air Resource Board improved an initiative that allows EVs to access HOV lanes, which are usually reserved only for high-occupancy vehicles, via the use of a green decal sticker. The state also offers a $1,500 rebate through the Clean Vehicle Rebate Project towards the purchase or lease of an approved "clean" vehicle.[17]

[iv] This payback period is based on the incremental cost of the vehicles divided by the annual cost savings in gasoline. It does not include maintenance costs.

3. Police on Bicycles

Strategy Description:
Police cars are usually heavy cars with large engines that get poor mileage and produce a large amount of GHG emissions per vehicle. Bicycles, on the other hand, produce no emissions. Converting police transportation from cars to bicycles will reduce fossil fuel use and therefore GHG emissions caused by government transportation.

Studies have also shown police on bicycles to be more effective than police in cars because police are viewed as more approachable, better able to connect with the public, and better able to observe what is happening. Police on bicycles can also pursue suspects in places where cars can't go.

- **Methodology:**
  - Bicycle officers
    - Assume 2 during 9am-5pm business hours
  - Price of gasoline
    - $3.30[18]
  - Average fuel economy
    - 13.6[19]
  - Average annual miles per vehicle
    - 16,372 miles[20]
  - Annual cost of bicycle and training
    - $1,000[21]
  - Annual cost of vehicle and operating
    - $7,800[22]

2	Bicycle Officers

$3.30	Price of Gasoline ($ per gallon)
14	Miles per Gallon of Police Car
16,372	Average Annual Miles per Vehicle
$1,000	Annual Cost of Bicycle and Training
$7,800	Annual Cost of Vehicle and Operating
2,408	Annual Gasoline Savings (gallons)
$7,945	Annual Fuel Cost Savings
$13,600	Total Annual Cost Savings

CO2e (metric tons)
23

Co-Benefits -Makes officers more approachable -Increases visible police presence in the city.		Success Story: -The Lafayette, IN police department has had a successful bike patrol since 2004. -Overall it is estimated that over 2,200 police departments in 43 states utilize some sort of bike patrol.[23]
	The Lafayette, IN Bike Patrol	

Buildings and Facilities

1. Energy Efficiency Retrofits of Existing Facilities

Strategy Description:
Buildings account for 40% of total energy use and about 35% of GHG emissions in the United States. Over the next few decades, most of this energy will be used by existing buildings. Many measures can be applied to existing buildings to improve their efficiency, including using efficient light bulbs and fixtures, replacing appliances with more efficient ones, increasing insulation, replacing windows, and upgrading HVAC systems. Local governments can set an example by making efficiency improvements to their own buildings. The jurisdiction can require improvements to private buildings when renovations are made or buildings are sold. Governments can also encourage efficiency improvements by offering low or zero interest loans to building owners for improvements. NYSERDA offers incentives for energy retrofits through its existing facilities program. Both prequalified incentives up to $30,000 for electric efficiency and up to $30,000 for natural gas efficiency measures; and performance-based incentives up to $2 million are available.

Many buildings are not equipped with the most recent energy efficient technologies, causing the City to use more energy than is necessary. Retrofitting existing facilities through measures like replacing appliances with more efficient ones, increasing insulation, and upgrading HVAC systems can greatly improve energy efficiency and therefore reduce emissions from the City's buildings and facilities.

The City has already begun to retrofit/create plans to retrofit its buildings, including LED lighting retrofits in the City Hall and Armory buildings, and plans to perform similar retrofits at the WWTP facility. The City also plans to upgrade HVAC equipment in the Armory and Kallet buildings within the next few years, as these buildings have old, inefficient/nonfunctional boilers.

- **Methodology:**
  - Square foot of facilities retrofitted
    - 196,830 square feet total, assume half government buildings are retrofitted by 2025→ 98,415 square feet
  - Price of electricity ($ per kWh)
    - $0.122 per kWh[24]
  - Price of natural gas ($ per therm)
    - $0.729 per therm[25]
  - Typical new construction annual energy use per square foot (kWh)
    - 17.172 kWh/sq. ft.[26]
  - Typical new construction annual energy use per square foot (therms)
    - 0.705 therms/sq. ft.[27]
  - Percent electricity savings
    - Assume 25%
  - Percent natural gas savings

- Assume 25%
- Retrofit Cost ($ per square foot)
  - $5[v]

98,415	Square Foot of Facilities Retrofitted

$0.122	Price of Electricity ($ per kWh)
$0.73	Price of Natural Gas ($ per therm)
17.2	Typical New Construction Annual Energy Use per Square Foot (kWh)
0.71	Typical New Construction Annual Energy Use per Square Foot (therms)
25	Percent Electricity Savings
25	Percent Natural Gas Savings
$5.00	Retrofit Cost ($ per square foot)
422,496	Total Annual Electricity Savings (kWh)
17,355	Total Annual Natural Gas Savings (therms)
$64,197	Annual Cost Savings
7.7	Simple Payback (years)

CO2e (metric tons)
193

Co-Benefits: -Reduce energy costs for heating and cooling -Makes geothermal, solar and wind energy more feasible	Energy Star's Portfolio Manager tool helps local governments track and assess energy and water consumption in existing buildings, identify the best opportunities for improvement, track immediate and cost effective reductions over time and document savings results.[28]	Success Stories: **- Village of Montebello, NY** - An Energy Audit of municipal buildings was completed along with lighting, insulation and Energy Star upgrades, saving one third on the village's energy bill. Montebello has also installed solar panels on the village hall. The mayor estimates that the village netted about $3,000 in "returned electricity."[29]

[v] Chris Carrick, CNY RPDB. It is important to note that retrofit costs and energy savings vary widely depending on the age and type of building being retrofitted and the measures being implemented.

2. Install Solar PV Panels

Strategy Description:

Solar photovoltaic (PV) energy production harnesses the sun's energy to produce electricity. GHG emissions reductions from this strategy are equal to the emissions that would have been produced if the electricity was supplied through fossil fuel based sources by the local utility because electricity generated from PV systems displaces electricity demand which would ordinarily be supplied by the local utility. Putting solar panels on city buildings is a good way to increase the visibility of solar energy in the community, while providing clean energy for building use. Contrary to popular belief solar power has been shown to be viable in a wide variety of climates that are not thought of as "sunny". Local governments can borrow money at low interest rates through bond issues, making solar more economical than it is for individuals or businesses. Some cities have combined solar energy with efficiency measures, with the shorter payback period of the efficiency measures helping to pay for the solar.

An increasingly popular way for a local government to overcome the financial hurdles of installing a photovoltaic system is through the "solar services model" also known as a Power Purchase Agreement (PPA). Through this type of arrangement the owner of a property can provide the space for a power producer to install the system. The property owner then agrees to buy the power produced from that system at a set rate that is competitive with grid electricity. Since the power producer retains ownership of the equipment, there are no installation and maintenance costs to the consumer of the electricity produced. This is particularly attractive to government entities that are unable to take advantage of tax based incentives for renewable energy.

NYSERDA, New York Power Authority (NYPA) and City University of New York (CUNY) developed a NYS Unified Solar Permit that helps to reduce costs for solar projects by streamlining municipal permitting processes and supports the growth of clean energy jobs across the state. The unified solar permit is part of Governor Cuomo's NY-Sun initiative to quadruple in 2013 the amount of solar capacity in New York that was added during 2011.

Adoption of a standardized residential/small business solar permit is a key element to help New York municipalities remove barriers to local economic development in the growing solar industry. The standardized permit cuts costs by creating a uniform permitting process in municipalities across the state. Installers in New York State have had to work with different permits and permitting processes in each of the State's 1,550 municipalities, which increased the complexity of permitting and have caused project delays and added costs. It is recommended that the City of Oneida adopt the unified solar permit to reduce soft costs associated with solar installations.

- **Methodology:**
  - kW of PV installed

        - Assume government installs 500 kW of PV[vi]
    - Price of electricity
        - $ 0.122 per kWh[30]
    - Sun hours per day
        - 3[31]
    - Cost of PV installation
        - $1,100 per kW[32]

500	kW of PV Installed

$0.122	Price of Electricity ($ per kWh)
3.0	Sun Hours per Day
$1,100	Cost of PV installation ($ per kW)
547,500	Annual Energy Production (kWh)
$66,795	Annual Cost Savings
8	Simple Payback (years) [vii]

CO2e (metric tons)
124

Co-Benefits

-Renewable energy

-Local energy

-Produces no air pollutants

Preble Town Hall with 9 kW solar PV panels installed on roof

Success Stories

-9 kW installed on Town Hall building in Preble, expected to save 9,720 kWh annually.[33]

[vi] Solar installations can be made on Kallet roof, which is to be upgraded in the next few years, on flood plain/housing demolition sites, on water storage tanks/reservoirs, on new DPW building, and/or in municipally-owned parking lots. Arista Power previously analyzed solar potential on municipal buildings as well, assuming 10-50 kW systems. Jon Rauscher, City Engineer, put together the following calculation:

Baker Tanks: (assume installation on south slope – 50%) = 41,500 sq ft. (350kW)
Kallet Roof: (assume 70% coverage)= 9,000 sq ft (70 kW)
City Hall: (assume partial 2nd story install): 2,600 sq. ft. (20 kw)
Armory: (south side of roof): 4,500 sq ft (35 kW)
Total: 475kW

[vii] Note: This calculation does not include maintenance costs.

3. Install Lighting Occupancy Sensors

Strategy Description:
Lighting is typically the largest electricity draw in commercial buildings. Energy is wasted by lights that are left on when no one is using them. Installation of lighting occupancy sensors prevents waste by using sensors to detect motion in the lighted space and turning lights off if no one is present. Sensors can reduce energy use for lighting by an average of 35%.

Sensors are usually either ultrasonic or infrared. If no motion is detected after a set delay period, the sensor turns off or dims lights. Occupancy sensors are a low-cost way to save energy on lighting, with a typical payback time of less than two years. This strategy is usually included when completing an energy-efficiency retrofit to an existing facility; however, occupancy sensors can also be implemented at a separate time or in buildings that do not undergo complete energy-efficiency retrofits, and this strategy is therefore included as a separate measure.

- **Methodology:**
  - Square foot of facilities installing occupancy sensors
    - 196,830 square feet total, assume half government buildings install occupancy sensors by 2025→ 98,415 square feet[viii]
  - Price of electricity ($ per kWh)
    - $0.122 per kWh[34]
  - Annual lighting energy use per square foot (kWh)
    - 6.85 (CAPPA estimate)
  - Percent savings with occupancy sensors
    - 35% (CAPPA estimate)
  - Cost of sensors ($ per square foot)
    - $0.06 (CAPPA estimate)

98,415	Square Feet Installed with Occupancy Sensors

$0.122	Price of Electricity ($ per kWh)
6.85	Annual Lighting Energy Use per Square Foot (kWh)
35	Percent Savings With Occupancy Sensors
$0.06	Cost of Sensors ($ per square foot)
235,950	Total Annual Electricity Savings (kWh)
$28,786	Annual Cost Savings
0.2	Simple Payback (years)

CO2e (metric tons)
54

[viii] Light sensors were installed prior to the GHG inventory in the City Hall and Justice Center.

Co-Benefits

- Security provided by motion sensor lighting

- Work automatically once installed

A typical lighting occupancy sensor

Success Stories

- DeWitt Town Hall installed light sensors in bathrooms, supply rooms, and other rooms where lights might normally be left on.[35]

4. Install Reflective Roofing

Strategy Description:
Buildings account for 40% of total energy use and about 34% of GHG emissions in the United States. Air conditioning is a close second to lighting for electricity use in most commercial buildings. Reflective roofing reduces the amount of heat that enters a building through the roof by reflecting the sun's energy instead of absorbing it as traditional dark rooftops do. ENERGY STAR – certified reflective roof products reflect at least 65% of sunlight striking the roof, lowering the roof temperature by up to 100℉. A reflective roof will only save energy on a building with air conditions, although it will keep a non-air conditioned building cooler. Reflective roofs cost about the same as traditional roofing products, so installing one during construction, or when roof replacement is needed anyway, involved no cost premium.

The City has received a grant to replace the Kallet's roof and is already looking into reflective roofing options.

- **Methodology:**
  - Square feet of reflective roof installed
    - Assume roof of City Hall building, approximately 18,757 square feet (already installed since 2010) and Kallet Civic Center, approx. 11,305 square feet[36] = approx. 30,000 ft.^{2}
  - Price of electricity
    - $0.122 per kWh[37]
  - Price of natural gas
    - $0.729 per therm[38]
  - Incremental cost of Energy Star roofing ($ per square foot)
    - $0.10[ix 39]

30,000	Square Feet of Reflective Roof Installed

$0.122	Price of Electricity ($ per kWh)
$0.73	Price of Natural Gas ($ per therm)
$0.10	Incremental Cost of ENERGY STAR Roofing ($ per square foot)
0.77	Annual Electricity Savings per Roof Square Foot (kWh)
(0.0133)	Annual Natural Gas Savings per Square Foot (therms)
23,220	Total Annual Electricity Savings (kWh)
(399)	Total Annual Natural Gas Savings (therms)
$3,124	Annual Cost Savings
1.0	Simple Payback (years) [x]

[ix] The following calculations are assuming the current roof has reached the end of its useful life, and now installing a green of reflective roof can be weighed against installing a new conventional roof instead of against doing nothing.
[x] Note: This calculation does not include maintenance costs.

CO2e (metric tons)
8

5. Institute a Power-Down at Night Policy

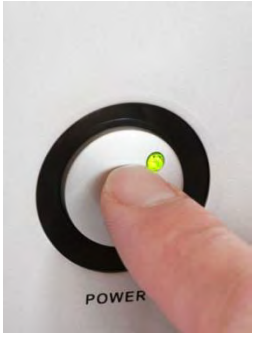
Strategy Description:
Many buildings waste a significant amount of energy when lights and other electronics are left on at night when they are not in use. Creating a policy of turning lights and other electronics off throughout buildings at the end of the work day reduces electricity wasted during non-business hours, therefore reducing GHG emissions from buildings and facilities. Lighting is typically the largest electricity user in commercial buildings. A power down at night policy can use a combination of education and technology like timers, power strips, and motion sensors.

- **Methodology:**
  - Square foot of facilities with Power-Down policy
    - Assume the City Hall, Justice Center, and Armory office space participates in policy = 7,520 square feet[40]
  - Price of electricity ($ per kWh)
    - $0.122 per kWh[41]
  - Annual lighting energy use per square foot (kWh)
    - 6.85 (CAPPA estimate)
  - Percent savings with policy
    - 35% (CAPPA estimate)
  - Cost of sensors ($ per square foot)
    - $0.06 (CAPPA estimate)

7,520	Square Feet with Power-Down at Night Policy

$0.122	Price of Electricity ($ per kWh)
6.85	Annual Lighting Energy Use per Square Foot (kWh)
35	Percent Savings With Policy
$0.06	Cost of Implementation ($ per square foot)
18,029	Total Annual Electricity Savings (kWh)
$2,200	Annual Cost Savings
0.2	Simple Payback (years)

CO2e (metric tons)
4

Co-Benefits	Success Stories
-Reduces light pollution -Reduces energy bill  	- NYSERDA estimates that power management (turning off underused office equipment or adjusting thermostats, upgrading to energy-efficient equipment, and encouraging changes in employee behavior) can reduce plug load by 40-60%, which would mean a statewide emissions reduction of more than 57,000 tons of CO_2 every year and significant savings on local government energy bills.[42] - Buffalo, NY - A project team found that low-cost/no-cost measures could reduce city government's power consumption by 595,060 kWh annually, saving an estimated $71,000. Measures for city hall include turning off copiers and printers after hours; shortening the period of inactivity before copiers go into "sleep mode" during business hours; reminding staff to shut down personal computers, monitors, and other plug-load equipment during extended daytime absences; replacing inefficient appliances with ENERGY STAR® models; specifying an upcoming new copier lease bid to ensure energy efficient models installed and properly configured.[43] - In 2009, Dunwoody, Georgia implemented a successful “power down” policy, aimed at reducing energy use while buildings are not in use. The municipality found that in order to successfully require businesses and citizens to participate, an ordinance must be constructed.[44]

6. Information Item: Hydro-Power

The City of Oneida can investigate the pros and cons of investing in hydro-power, which would reduce greenhouse gas emissions produced by using combusted fossil fuels as energy sources. Millions of gallons of water flow over the Mt. Hope Reservoir every year, and Oneida Creek runs through the City- both of which offer the opportunity for hydro-power production in the City. The power created by micro-hydro projects could be used to power the business park.

Streetlights

7. Removal of City-Owned Ornamental Streetlights / Installing LED Streetlights

Strategy Description:
Streetlighting is often one of the largest items in a local government's energy budget. Many cities still have older, inefficient, mercury vapor lamps or incandescent bulbs in street lights. LEDs have been used to successfully reduce energy use for traffic signals, and some cities are choosing to install LEDs for Streetlighting applications. LEDs are highly efficient, and their light is directional, making it easy to focus them on roads, avoiding ambient light pollution and energy waste.

Older, inefficient mercury vapor lamps or incandescent bulbs in street lights require more energy than newer, more efficient LED (light emitting diode) bulbs. Switching inefficient lighting with LEDs will reduce electricity use, therefore reducing associated GHG emissions.

The City of Oneida owns 86 ornamental lights that are going to be removed. The City has 824 more lights that are owned by National Grid that could be switched to LEDs in the future; however, in order to switch these 824 lights, the City would have to buy those light systems from National Grid because currently National Grid will not install LED lighting. National Grid will not install LED lighting at the present time because there is no tariff structure for incentives to replace the equipment, so the amount it costs National Grid to convert lights to LEDs would absorb any energy savings. Another reason National Grid currently does not install LED streetlights is because LED streetlight technology is still in its infancy so any LED streetlights implemented now will most likely be an inefficient LED streetlight technology within a few years and need to be replaced again.[45]

This document therefore investigates possible reductions should the 824 streetlights in Oneida be converted to LEDs by National Grid in the future as an informational item. Potential emissions reductions of converting to LEDs are not included in overall reduction calculations for the City.

The City is currently looking to replace 400W HPS streetlights with 175W metal halide lights, or LED if the technology is available through National Grid at time of installation.

- **Methodology**
  - Number of streetlights converted
    - 86 ornamental street lamps owned by City, 100W HPS lamps to be removed
    - 824 HPS (mostly 100W) National Grid-owned
  - Hours of streetlight operation
    - Assume 11 hours daily
  - Price electricity
    - $0.272 per kWh[46]

- Percent Mercury Vapor Lamps
  - 0%[47]
- Percent Metal Halide Lamps
  - 0%[48]
- Percent High Pressure Sodium Lamps
  - 100%[49]
- Percent Low Pressure Sodium Lamps
  - 0%[50]
- Wattage of Mercury Vapor Lamps
  - N/A
- Wattage of Metal Halide Lamps
  - N/A
- Wattage High Pressure Sodium Lamps
  - Assume 100W (majority of both City-owned and NG-owned are 100W)[51]
- Wattage Low Pressure Sodium Lamps
  - N/A

City-Owned Lights: to be removed

86	Street Lights removed

11	Hours of Streetlight Operation
$0.272	Price of Electricity ($ per kWh)
0	Percent Mercury Vapor Lamps
0	Percent Metal Halide Lamps
100	Percent High Pressure Sodium Lamps
0	Percent Low Pressure Sodium Lamps
0	Wattage of Mercury Vapor Lamps
0	Wattage of Metal Halide Lamps
100	Wattage of High Pressure Sodium Lamps
0	Wattage of Low Pressure Sodium Lamps
34,529	Total Annual Energy Savings (kWh)
$9,392	Annual Cost Savings

CO2e (metric tons)
8

NG-Owned Lights

824	Street Lights Replaced with LED Street Lights

11	Hours of Streetlight Operation
$0.272	Price of Electricity ($ per kWh)
0	Percent Mercury Vapor Lamps

0	Percent Metal Halide Lamps
100	Percent High Pressure Sodium Lamps
0	Percent Low Pressure Sodium Lamps
0	Wattage of Mercury Vapor Lamps
0	Wattage of Metal Halide Lamps
100	Wattage of High Pressure Sodium Lamps
0	Wattage of Low Pressure Sodium Lamps
165,418	Total Annual Energy Savings (kWh)
$44,994	Annual Cost Savings
	Simple Payback (years)[xi]

CO2e (metric tons)
38

Co-Benefits -Reduce energy costs -Lower maintenance costs -Useful life of LED bulbs are much greater than traditional bulbs		Success Stories - The Village of Solvay, NY converted their municipally-owned streetlights to LED streetlights in the summer of 2012. Their electric usage is less than half of what it was with the older lights and saved the village $12,000 annually.[52]

[xi] Payback uncertain since this strategy would require a buy-out of National Grid lighting, or else National Grid would add costs into tariff structure. Payback can be calculated once it is determined how these lights would be converted and by whom.

Water Delivery Facilities

1. **Improve Water Pumping Energy Efficiency**

Strategy Description:
Many water systems have old, inefficient pumps that can be upgraded with short payback times from energy savings. Motors can be rewound for greater efficiency. Variable speed drives allow a pump to operate more efficiently. Pump sizing is also important as an oversized pump wastes energy. Combining multiple pumps of different sizes can allow a smaller pump to be sufficient for normal operations, with the additional pump meeting peak demand. Pump system optimization can reduce energy use by 20%.

Regular preventative inspection and maintenance keeps pumping systems working efficiently. Monitoring energy use of each component helps decide where further improvements can be made. Controlling leaks is also an important component of improving system efficiency.

- **Methodology:**
  - Households served by water authority
    - 4,479 in City of Oneida[53]
  - Price of electricity ($ per kWh)
    - $0.127[54]
  - Typical daily household water use (gallons)
    - 355,774,000 gallons total for City of Oneida in 2011[55] / 4,479 households = 79,432 gallons per household per year / 365 = 218 gallons per household per day
  - Energy use for water pumping and treatment (kWh per gallon)
    - Total gallons pumped by City of Oneida Water Department in 2011 = 800,646,000 gallons
    - Total kWh used by water department pump stations = 80,160 kWh + 38,422 kWh[56] = 118,582 kWh
    - 118,582 kWh / 800,646,000 gallons = .000148 kWh/gallon
  - Percent energy savings from upgrades
    - CAPPA estimate 20%
  - Cost of upgrades
    - CAPPA estimate $200,000

4,479	Households Served by Water Authority

$ 0.1270	Price of Electricity ($ per kWh)
218	Typical Daily Household Water Use (gallons)
.0001	Energy Use for Water Pumping and Treatment (kWh per gallon)
20	Percent Energy Savings from Upgrades

$10,000	Cost of Upgrades ($)[xii]
10,549	Total Annual Electricity Savings (kWh)
$1,340	Annual Cost Savings
7.5	Simple Payback (years)

CO2e (metric tons)
2

Co-Benefits
- Reduced energy costs
- Energy cost savings from efficiency measures can be used for other municipal tasks

Success Stories
- A study of 5 wastewater pumps in Rensselaer County, NY found that replacing them could save 737,000 kWh a year, with payback times between 2 and 6 years.[57]

[xii] This is the cost at which it would make sense for the City to upgrade water pumps because the payback would be under 10 years and the emissions reductions are only 2 MTCO2e.

Wastewater Treatment Facilities

1. **Information Item: Using methane created during treatment process to power boiler system**

The Wastewater Treatment Facility currently has a cogeneration system that is not properly functioning due to low methane production at the facility. The City therefore is flaring methane produced during treatment. The City is investigating alternate uses for the methane, such as using the methane to power a boiler system so that the methane can be utilized effectively instead of being flared. This process would reduce greenhouse gas emissions from wastewater treatment processes, reduce need for fossil energy to heat the Wastewater Treatment Facility, and reduce costs.

Community Strategies

Transportation

1. Expand Bicycling Infrastructure

Strategy Description:
Improving bicycle paths and facilities will allow bicycling to become a more realistic and widely used transportation option, especially for shorter trips (up to five miles). Replacing vehicle trips with bicycle trips will decrease the amount of fossil fuels used for transportation, decreasing emissions and fuel costs. Improving bicycling paths and facilities can include a variety of measures, such as implementing sharrows or dedicated bicycling lanes on roadways, installing bicycle racks, or even providing lockers and shower facilities for employees who choose to bicycle to work.

The City would like to increase bicycling paths in various ways, including through the rehabilitation and expansion of a rail trail utilizing 11 miles of abandoned railroad tracks through the City. The City has already received funding for 3.1 miles to be developed as a bike/walking path starting by the Erie Canal towpath in Wampsville. The trail is expected to connect multiple sections of abandoned railroad tracks, running through portions of City roads and looping back to the start. Bike paths and infrastructure therefore need to be installed on City roads, which will be useful to community members even if not riding on the rail trail.

The City is also planning to implement a "complete streets" design in the section of roadway outside of City Hall. "Complete streets" is the idea that new streets are constructed (or existing streets are updated) to allow for access to a variety of modes of transportation, shifting the focus from cars to alternative forms of transportation. Complete streets therefore encompasses multiple strategies, including but not limited to: expanding bicycling infrastructure, promoting carpooling/vanpooling, and creating walking-friendly environments.

- **Methodology**
  - Weekly trips switching from car to bicycle
    - Annual VMT= 90,351,031.843 miles[58] * (2/3)[xiii] = 60,234,021 AVMT
    - 60,234,021 AVMT AVMT / 365 days = 165,025 DVMT
    - 165,025 DVMT * 210 days bicycles could be in use = 34,655,250 AVMT possible for bicyclists
    - 34,655,250 AVMT / 2 (one-way trips- accounting for one trip to work and one trip home) = 17,327,625 AVMT of one-way trips
    - 17,327,625 AVMT of one-way trips / 210 days of bicycling = 82,513 daily VMT of one-way trips
    - 82,513 daily VMT of one-way trips * 40%[xiv] [59] = 33,005 DVMT of one-way trips less than 2 miles

[xiii] Assuming 1/3 of VMT is through traffic that does not begin or end in Oneida

        - 33,005 DVMT of one-way trips less than 2 miles / 1 mile (assumed average trip length of all trips less than 2 miles) = 33,005 total daily trips less than 2 miles
        - 33,005 total daily trips less than 2 miles * 25% (assumed percentage of trips changing to bicycle) = 8,251 daily trips less than 2 miles changed to bicycle
        - 8,251 daily trips less than 2 miles changed to bicycle * 7 days per week = **57,757 weekly trips less than 2 miles changed to bicycle**
    - Price of gasoline
        - $3.56[60]
    - Average length of avoided trip (miles) due to expanded bike infrastructure
        - Use CAPPA estimation/source – 4 miles
    - Average fuel economy
        - 23.5 mpg[61]

57,757	Weekly Trips Switching from Car to Bicycle

$3.56	Price of Gasoline ($ per gallon)
4	Avg length of avoided trip (mi)
23.5	Average Fuel Economy
12,013,456	Annual Vehicle Mile Reduction
511,211	Annual Gasoline Savings (gallons)
$1,819,911	Annual Cost Savings[xv]

CO2e (metric tons)
4,812

Co-Benefits

-Alternate transportation such as biking promotes exercise and a healthier population

-Reduced fuel costs

-Reduced local pollution

-Reduced reliance on foreign oil

Bicyclists on the Onondaga Creekwalk, Syracuse, NY

Success Stories

-The Creekwalk in Syracuse, NY allows walking or biking through the city, including to and from Destiny USA.[62]

-Midtown Greenway in Minneapolis, Minnesota – 5.5 mile bike pathway is traveled by 3,500 cyclists daily, often allowing them to travel faster than drivers.[63]

[xiv] Percent of trips less than 2 miles
[xv] Note: This calculation does not include maintenance costs.

2. Increase Telecommuting

Strategy Description:
Computers, modems, the Internet, telephones and fax machines—everything is now in place to allow many employees to work at home. Some can do it part time, some full time. Use advanced telephones and, if possible, video cameras to meet with individuals rather than travel to meet with the people face to face. A variation on this theme is to furnish or rent office space at a strategic location near employees who formerly commuted long distances. Other ways to reduce the need to commute: change the work week—to ten hours a day for four days, or nine hours a day for five days, for example. All these options reduce commuting miles for employees and shift traffic to more efficient off-peak hours.

While telecommuting reduces driving to work, it may free up vehicles for other uses like running errands, so the net driving reduction may be less than the reduction in commuting. Telecommuting encouragement programs are most effective if combined with other programs to reduce driving, like parking fees or parking cash-out programs and congestion pricing.

- **Methodology:**
  - Number of employees offered telecommuting incentives
    - 5,853 people with primary jobs in City of Oneida,[64] assume all are offered incentives but only 5% utilize them (below)[65]
  - Price of gasoline
    - $3.56[66]
  - Percent of employees telecommuting each workday
    - Assume 5%[67]
  - Average one-way commute length (mi)
    - Average one-way commute lengths
      - 1,821 commute less than 10 miles to work (avg. 5 miles)[68]
        - 1,821 x 5 = 9,105 miles
      - 1,443 commute 10-24 miles to work (avg. 17 miles)
        - 1,443 x 17 = 24,531 miles
      - 681 commute 25-50 miles to work (avg. 37.5 miles)
        - 681 x 37.5 = 25,537.5 miles
      - 2,008 commute more than 50 miles to work (50 miles)
        - 2,008 x 50 = 100,400 miles
      - 9,105 + 24,531 + 25,537.5 + 100,400 = 159,573.5 miles total
      - 159,573.5 / 5,853 (total primary jobs) = 27.3 miles
  - Average fuel economy
    - 23.5 mpg[69]

5,853	Employees Offered Telecommuting Incentives

$3.56	Price of Gasoline ($ per gallon)
5	Percent of Employees Telecommuting each Workday

27.3	Average One-way Commute Length (mi)
23.5	Average Passenger Vehicle Fuel Economy
3,834,886	Annual Vehicle Mile Reduction
163,187	Annual Gasoline Savings (gallons)
$580,944	Annual Cost Savings

CO2e (metric tons)
1,536

Co-Benefits

- Reduces traffic

- Reduces local noise and air pollution

- Reduces reliance on foreign fuels

Success Stories

- The State of Arizona has successfully encouraged more than 4,000 state employees to telework, reducing driving by 5.25 million miles a year.[70]

3. Construct Electric Vehicle Recharging Facilities

Strategy Description:
Electric vehicle charging stations are an effective way to promote and incentivize electric vehicle usage. Because electric vehicles require electricity to operate instead of fossil fuels, emissions from transportation have the potential to decrease if electric vehicle charging stations are implemented. In 2013, NYS Governor Andrew Cuomo announced the Charge NY program which calls for investment in 3,000 public and workplace charging stations by 2018. NYS expects the number of EVs to increase to as many as 40,000 by 2018, and a million by 2025. The NYS Cleaner Greener Communities program has also made up to $1 million available for communities to adopt streamlined permitting and other ordinances for electric vehicle charging stations, funding is available in the amount of $2,500 per project for applicants representing a population of up to 30,000 residents.

The City is interested in installing electric vehicle charging facilities, potentially in the City Hall or other City-owned parking lots to encourage electric vehicle use.

- **Methodology**
  - Number of charging stations
    - Assume 5
  - Price of gasoline
    - $3.56[71]
  - Price of electricity
    - $0.125 per kWh[72]
  - MPG of vehicles replaced
    - 23.5 mpg[73]
  - Avg. annual vehicle miles per charging space
    - Approximate driving range of 100 miles before needing to be to be recharged[74]
    - Nissan Leaf owners did 67% of their charging at home in 3rd quarter of 2012[75], so 33% of charging was done at charging stations.
    - 33% of 100 = 33 miles per charge at charging station
    - 33 miles x 365 days per year = 12,045 avg. annual vehicle miles per charging space

5	Number of Charging Spaces

$3.56	Price of Gasoline ($ per gallon)
$0.1250	Price of Electricity ($ per kWh)
23.5	Miles per Gallon of Vehicle Replaced
12,045	Average Annual Vehicle Miles per Charging Space
2,563	Annual Gasoline Savings (gallons)
22	Annual Electricity Use (kWh)

$9,121	Annual Cost Savings[xvi]

CO2e (metric tons)
24

Co-Benefits	Success Stories
-Electric vehicles have a lower operating cost than gasoline vehicles -Reduces local air pollution Installation of Blink electric car charging station in Syracuse, NY	-Governor Cuomo announced on April 11, 2013 that more than 360 electric vehicle and plug-in hybrid charging stations will be installed across the state in support of his Charge NY initiative, which is an initiative to create a statewide network of up to 3,000 public and workplace charging stations over the next five years and to put up to 40,000 plug-in vehicles on the road during that period.[76] -68 electric vehicle charging stations have been installed in Syracuse, NY by Syracuse Synapse Sustainable Trust. A 22 kW rooftop solar panel system helps power 9 charging stations outside SST's headquarters. Electric vehicle fueling cost = about 1/5 that of gasoline.[77] -Houston partnered with eVgo, ECOtality, GRIDbot, and Coulomb Technologies to study, plan, and install electric vehicle charging stations and hope to eventually have a minimum of 200 charging stations in the city.[78]

[xvi] Note: This calculation does not include maintenance costs.

4. Conversion to Electric Vehicles

Strategy Description:
Electric vehicle charging stations are an effective way to promote and incentivize electric vehicle usage. Because electric vehicles require electricity to operate instead of fossil fuels, emissions from transportation have the potential to decrease if electric vehicle charging stations are implemented. In 2013, NYS Governor Andrew Cuomo announced the Charge NY program which calls for investment in 3,000 public and workplace charging stations by 2018. NYS expects the number of EVs to increase to as many as 40,000 by 2018, and a million by 2025. The NYS Cleaner Greener Communities program has also made up to $1 million available for communities to adopt streamlined permitting and other ordinances for electric vehicle charging stations, funding is available in the amount of $2,500 per project for applicants representing a population of up to 30,000 residents.

- **Methodology**
  - Number of vehicles switching
    - 6,485 community vehicles,[79] assume 5% make the switch = 174 vehicles
  - Price of gasoline
    - $3.56[80]
  - Price of electricity ($ per kWh)
    - $0.125 per kWh[81]
  - MPG of vehicles replaced
    - 23.5 mpg[82]
  - Average annual miles per vehicle
    - AVMT= 90,351,031.843 miles[83]
    - Assume 1/3 miles are through traffic (do not begin or end in City of Oneida) = 90,351,031.843 *(2/3) = 60,234,021
    - 60,234,021- 523,288 miles total gov VMT[84] = 59,710,733
    - 59,710,733 / 6,485 total community vehicles = 9,208 average annual miles per vehicle
  - Incremental cost of electric vehicle vehicle
    - Nissan Leaf base 2013 = MSRP $35,690
    - Toyota Camry base 2013 = MSRP $23,030
    - $35,690 - $23,030 = $12,660
    - Plus a Federal tax credit up to $7,500 of Nissan Leafs purchased in or after 2010; $12,660 - $7,500 = $5,160

174	Number of Electric Vehicles

$3.56	Price of Gasoline ($ per gallon)
$0.1250	Price of Electricity ($ per kWh)
23.5	Miles per Gallon of Vehicle Replaced
9,208	Average Annual Miles per Vehicle

$5,160	Incremental Cost of Electric Vehicle
68,178	Annual Gasoline Savings (gallons)
577	Annual Electricity Use (kWh)
$242,643	Annual Cost Savings
3.7	Simple Payback (years) [xvii]

CO2e (metric tons)
642

Co-Benefits	Success Stories
-Reduces local air pollution -Lower operating cost than gasoline vehicles Installation of Blink electric car charging station in Syracuse, NY	-Governor Cuomo announced on April 11, 2013 that more than 360 electric vehicle and plug-in hybrid charging stations will be installed across the state in support of his Charge NY initiative, which is an initiative to create a statewide network of up to 3,000 public and workplace charging stations over the next five years and to put up to 40,000 plug-in vehicles on the road during that period.[85] -The Kanagawa Prefecture in Japan is the most successful electric vehicle region in the world, with 2,183 registered electric vehicles. In the US, citizens of cities like Los Angeles (2,000 registered electric vehicles), Portland (1,300 registered electric vehicles), New York City (238 registered electric vehicles), and Research Triangle, NC (134 registered electric vehicles) have begun to realize the benefits of electric vehicles as well[86]. -California offers several types of incentives to encourage drivers to make the switch to electric vehicles. The California Air Resource Board improved an initiative that allows EVs to access HOV lanes, which are usually reserved only for high-occupancy vehicles, via the use of a green decal sticker. The state also offers a $1,500 rebate through the Clean Vehicle Rebate Project towards the purchase or lease of an approved "clean" vehicle.[87]

[xvii] Note: This calculation does not include maintenance costs.

5. Improve/Expand Pedestrian Infrastructure

Strategy Description:
Walking brings health and environmental benefits, reduces traffic congestion, and brings customers to business along the walking route. In comparison across urban areas each shift of one percent of trips to walking and bicycling means each person drives 700 miles less each year. Walking is most common in high-density areas with mixed residential and commercial uses, but there are things cities, suburbs, and even rural areas of any density can do to encourage and improve conditions for walking.

Planning that prioritize pedestrian needs will yield a quite different design from planning that prioritizes automobiles. Adequate sidewalks and crosswalks are essential. Wide sidewalks are more attractive, and a barrier between pedestrians and traffic, such as trees, planters, or on-street parking feels safer. A smaller curb radius at intersections leaves a smaller distance for pedestrians to cross and forces turning vehicles to slow down. Slowing down traffic increases pedestrian safety. This can be achieved by speed humps and using traffic circles in intersections. Converting one-way streets to two-way not only slows traffic, but also increases business activity and investment along the streets. Some US cities have closed off a few blocks of downtown commercial streets for pedestrians only, and many European cities have larger, pedestrian-only zones.

People prefer to walk in interesting environments. Building facades and architecture, and urban art contribute to this.

The City plans to expand walking-friendly environments through the development of the aforementioned rail trail and "complete streets" design outside City Hall (see Expand Bicycling Infrastructure for more information).

- **Methodology**
  - Weekly trips switching from car to bicycle
    - Annual VMT = 90,351,031.843 miles[88] * (2/3)[xviii] / 365 = 165,025 DVMT
    - (1,963,721*28% of trips are less than 1 mile[89])*5% changing to walking*7 days = 57,759
  - Price of gasoline
    - $3.56[90]
  - Average length of avoided trip (miles) due to expanded bike infrastructure
    - Use CAPPA estimation/source – 1 mile
  - Average fuel economy
    - 23.5 mpg[91]

57,759	Weekly Trips Switching from Car to Walking

[xviii] Assume 1/3 miles are through traffic (do not begin or end in City of Oneida)

$3.56	Price of Gasoline ($ per gallon)
1	Average Length of Avoided Trip (mi)
23.5	Average Passenger Vehicle Fuel Economy
3,003,468	Annual Vehicle Mile Reduction
152,460	Annual Gasoline Savings (gallons)
$542,759	Annual Cost Savings[xix]

CO2e (metric tons)
1,435

Co-Benefits

-Alternate transportation such as walking promotes exercise and a healthier population

-Reduced fuel costs

-Reduced local pollution

-Reduced reliance on foreign oil

Creekwalk in Syracuse, NY

Success Stories

-The Creekwalk in Syracuse, NY allows walking or biking through the city, including to and from Destiny USA.[92]

[xix] Note: This calculation does not include maintenance costs.

6. Conversion to Hybrid Vehicles

Strategy Description:
Hybrid/electric vehicles couple an electric drive with a gasoline engine and are widely available and are suited for a variety of applications. Hybrid vehicles are being used as taxi cabs in New York City and San Francisco. In 2006, Ford Motor Company pledged to make hybrid versions of half of their fleet, and automakers are increasingly making hybrid/electric versions of existing models.

Hybrids are less expensive to operate than regular vehicles, and while key issues related to battery life still remain, maintenance and fuel savings costs are expected to outweigh the price of battery replacement.

- **Methodology**
  - Number of hybrids
    - 6,485 community vehicles,[93] assume 15% are changed to hybrid = 973 vehicles
  - Price of gasoline
    - $3.56[94]
  - MPG of vehicles replaced
    - 23.5 mpg[95]
  - Average annual miles per vehicle
    - AVMT= 90,351,031.843 miles[96]
    - Assume 1/3 miles are through traffic (do not begin or end in City of Oneida) = 90,351,031.843 *(2/3) = 60,234,021
    - 60,234,021- 523,288 miles total gov VMT[97] = 59,710,733
    - 59,710,733 / 6,485 total community vehicles = 9,208 average annual miles per vehicle
  - Hybrid MPG
    - 46-55 MPG hybrid cars[98]
    - Assume 46 MPG
  - Incremental cost of hybrid vehicle
    - Toyota Prius Two base 2013 = MSRP $24,960[99]
    - Toyota Camry base 2013 = MSRP $23,030
    - $24,960 - $23,030 = $1,930

973	Number of Hybrids Used

$3.56	Price of Gasoline ($ per gallon)
46	Hybrid Miles per Gallon
23.5	Miles per Gallon of Vehicle Replaced
9,208	Average Annual Miles per Vehicle
$1,930	Incremental Cost of Hybrid
186,481	Annual Gasoline Savings (gallons)
$663,873	Annual Cost Savings

2.8	Simple Payback (years) [xx]

CO2e (metric tons)
1,755

Co-Benefits	Success Stories
- Reduces local air pollution -Less expensive to operate than regular vehicles -Reduces reliance on foreign oil	-Rockland County initiated the greening of its municipal fleet with Local Law 4 of 2006, which included a timeline for converting the entire fleet to hybrids or alternative fuel vehicles by 2010.[100] -NYSERDA provides financial assistance and technical information to encourafe fleets to purchase alternative fuel vehicles and install fueling facilities or charging stations. Certain hybrid-electric vehicles are eligible under many of the programs NYSERDA offers. [101] -Houston's light duty passenger fleet has become over 50% hybrid, making it the 3rd largest municipal hybrid fleet in the US[102].

[xx] Note: This calculation does not include maintenance costs.

7. Increase Bus Ridership

Strategy Description:
Because buses carry many people in a single vehicle, they are much more efficient than personal automobiles. Reducing vehicle miles by encouraging people to switch to riding the bus reduces emissions.

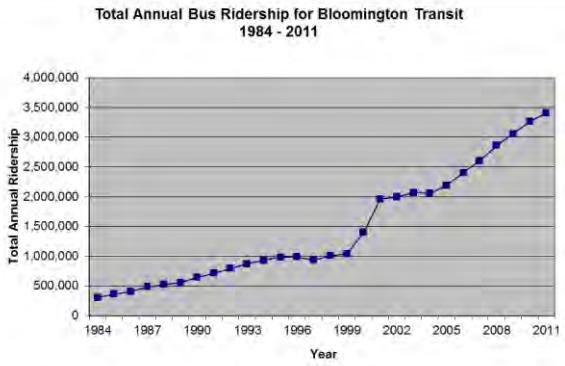
High quality public transit provides multiple co-benefits besides energy savings and emission reductions, including congestion reductions, road and parking facility cost savings, consumer savings and affordability (cost savings skewed toward lower-income users), improved mobility for non-drivers, support for strategic land development objectives (i.e. reducing sprawl), and improved public fitness and health. These co-benefits should be considered when evaluating public transit cost efficiency.

- **Methodology**
  - Increased number of passengers[103]
    - 43 rides per day, assume 10% increase = 47 rides per day, increased number of passengers = 4
  - Price of Gasoline ($ per gallon)
    - $3.56[104]
  - Average trip length
    - 1,821 commute less than 10 miles to work (avg. 5 miles)[105]
      - 1,821 x 5 = 9,105 miles
    - 1,443 commute 10-24 miles to work (avg. 17 miles)
      - 1,443 x 17 = 24,531 miles
    - 581 commute 25-50 miles to work (avg. 37.5 miles)
      - 581 x 37.5 = 21,787.5 miles
    - 2,008 commute more than 50 miles to work (50 miles)
      - 2,008 x 50 = 100,400 miles
    - = 155,823.5 miles total
    - 155,823.5 / 5,853 (total primary jobs) = 26.6 miles
  - Average passenger vehicle fuel economy
    - 23.5 mpg[106]

4	Number of Additional Daily Bus Passengers

$3.56	Price of Gasoline ($ per gallon)
26.6	Average One-way Commute Length (mi)
23.5	Average Passenger Vehicle Fuel Economy
51,072	Annual Vehicle Mile Reduction
2,173	Annual Gasoline Savings (gallons)
864	Increased Diesel Use (gallons)

CO2e (metric tons)
12

Co-Benefits -Reduce Congestion on Public Roads -Lower Transportation Emissions -Help stimulate local economy		Success Stories: -Bloomington, Indiana a city that also contains a college has increased bus ridership by over 25% since 2006. -Their goal is to have 7.5 million riders by 2014.[107]
	This chart shows the steady increase in ridership since 1984[108]	

8. Promote Carpooling/Vanpooling

Strategy Description:
A carpool is a group of two or more people who commute to work or other destinations together in a private vehicle. Carpool members work out their own agreements on who drives and how often, schedules, and payments for gas and maintenance. Carpooling allows multiple people to share a personal vehicle, so less fuel is used per passenger. Carpooling reduces total VMT, thus reducing GHG emissions and fuel costs.

One way to encourage carpooling/vanpooling is to create an electronic bulletin board where community members can go to request or offer rides. This bulletin board could be placed on the City website or some other easily accessible location. Another possibility is to encourage community members to take advantage of carpooling smart phone apps, such as Uber or Lift, which also provide a forum for requesting rides. Another program that will encourage carpooling and vanpooling is to offer a guaranteed ride home. Studies have shown that many employees commute by car so they can get home quickly if something comes up— such as an emergency or a call from school. Address this concern by guaranteeing employees a ride home—by taxi or company car—when needed.

- **Methodology**
  - Number of Employees Offered Carpool Incentives
    - 5,853 total primary jobs – 1,111 in City = 4,742 City residents commuting outside of City
    - Assume 15% participate in carpooling
    - 4,742 * 15% = 711
  - Price of Gasoline ($ per gallon)
    - $3.56[109]
  - Percent Reduction in Commute Vehicle Trips
    - Assume 10%
  - Average One-way Commute Length (mi)
    - 1,821 commute less than 10 miles to work (avg. 5 miles)[110]
      - 1,821 x 5 = 9,105 miles
    - 1,443 commute 10-24 miles to work (avg. 17 miles)
      - 1,443 x 17 = 24,531 miles
    - 581 commute 25-50 miles to work (avg. 37.5 miles)
      - 581 x 37.5 = 21,787.5 miles
    - 2,008 commute more than 50 miles to work (50 miles)
      - 2,008 x 50 = 100,400 miles
    - = 155,823.5 miles total
    - 155,823.5 / 5,853 (total primary jobs) = 26.6 miles
  - Average Passenger Vehicle Fuel Economy
    - 23.5 mpg[111]

Community

711	Employees Offered Carpool and Vanpool Incentives

Community

$3.56	Price of Gasoline ($ per gallon)
10	Percent Reduction in Commute Vehicle Trips
26.6	Average One-way Commute Length (mi)
23.5	Average Passenger Vehicle Fuel Economy
907,805	Annual Vehicle Mile Reduction
38,630	Annual Gasoline Savings (gallons)
$137,523	Annual Cost Savings

Community

CO2e (metric tons)
364

Co-Benefits		Success Stories
- Reduces local air pollution -Reduces reliance on foreign oil -Improve relations between community members	 www.transportation.boisestate.edu	**- Albany, NY Carpool Incentive Program** The Office of General Services (OGS) and the Governor's Office of Employee Relations offers a carpool incentive program for state employees working in downtown Albany. The program is designed to decrease the number of vehicles on Capital District roadways, improve air quality, and provide convenience and reduced costs to those seeking parking in OGS-managed lots and garages.[112]

Residential Energy Use

1. Promote Energy Efficiency through Campaign Targeted at Residents

Strategy Description:
Educational programs targeted at residents can provide information to residents about energy saving measures they can take in their homes, such as replacing appliances with energy efficient ones, sealing leaks and increasing insulation, or turning the thermostat down in cold weather and up in hot weather. Specifically, the CNY Energy Challenge Team Program teaches participants these and other techniques to reduce household energy usage. The program has seen a 29% reduction in energy usage for participants, thus reducing GHG emissions and energy costs significantly. The NYSERDA Home Performance with ENERGY STAR program provides incentives for 1-4 unit residential properties to improve building energy efficiency. Additionally, the Green Jobs Green NY (GJGNY) program provides free* comprehensive energy assessments to all 1-4 family households in NYS.

The City can also create an "Energy Resources" page on their website with educational links about various energy efficiency programs/resources for homeowners and businesses.

- **Methodology:**
  - Number of households targeted
    - Assume 10% → Total occupied households = 4,479[113] * 10% = 448 households
  - Price of electricity
    - $0.125 per kWh[114]
  - Price of natural gas
    - $1.30 per therm[115]
  - Typical household electricity use (kWh per year)
    - 27,074,556 kWh for residential total[116] / 4,479 homes = 6,045 kWh per home
  - Typical household natural gas use (therms)
    - 2,423,529 therms for residential total[117] / 4,479 homes = 541 therms per home per year
  - Percent Electricity Savings
    - Percent energy savings total = 29%[118]
  - Percent natural gas Savings
    - Percent energy savings total = 29%[119]
  - Cost of education program ($ per household)
    - Assume nothing

448	Number of households targeted

$0.125	Price of Electricity ($ per kWh)
$1.30	Price of natural gas ($ per therm)

6,045	Typical household electricity use (kWh per year)
541	Typical household natural gas use (therms per year)
29	Percent electricity savings
29	Percent natural gas savings
$0	Cost of Education Program ($ per home)[xxi]
785,366	Total Annual Energy Savings (kWh)
70,287	Total Annual Energy Savings (therms)
$423	Annual Cost Savings per household
$189,544	Total Annual Cost Savings
0.0	Simple Payback (years)

CO2e (metric tons)
572

Co-Benefits		Success Stories
-Save on electricity bills		-29% savings in pilot study of CNY Energy Challenge Team Program.

[xxi] Note: The CNY Energy Challenge Team Program is free for the homeowner to participate. Costs to the homeowner depend upon the measures they choose to take because of what they learned through the program.

2. Install Residential Solar PV Panels

Strategy Description:
Solar photovoltaic (PV) energy production harnesses the sun's energy to produce electricity. GHG emissions reductions from this strategy are equal to the emissions that would have been produced if the electricity was supplied through fossil fuel based sources by the local utility because electricity generated from PV systems displaces electricity demand which would ordinarily be supplied by the local utility. Contrary to popular belief solar power has been shown to be viable in a wide variety of climates that are not thought of as "sunny". Investments in solar energy should be combined with efficiency measures, with the shorter payback period of the efficiency measures helping to pay for the solar investment.

Many residents or businesses would like to use solar power, but the large up-front cost is an obstacle. Local governments can help overcome this barrier by paying a portion of system costs, offering low-interest loans, or organizing group buying programs to negotiate lower prices such as the Solarize Madison program in Madison County. These programs are an effective way of combining public and private funds for renewable energy. The New York State Energy Research and Development Authority (NYSERDA) provides incentives for the installation of Solar PV based on system size. Additionally there are state and federal tax credits for residential and commercial Solar PV installations. Educational and technical assistance programs can also promote solar power. Local governments can offer information clearinghouses and connect consumers with solar installers.

An increasingly popular way for businesses to overcome the financial hurdles of installing a photovoltaic system is through the "solar services model" also known as a Power Purchase Agreement (PPA). Through this type of arrangement the owner of a property can provide the space for a power producer to install the system. The property owner then agrees to buy the power produced from that system at a set rate that is competitive with grid electricity. Since the power producer retains ownership of the equipment, there are no installation and maintenance costs to the consumer of the electricity produced.

Similar to PPAs, residential and commercial property owners can take advantage of leasing agreements which will lower costs of implementing PV systems. Regional solar developers are currently offering lease products from companies like Sungevity and SunPower. These agreements allow property owners to install solar with no upfront cost. A monthly fee must be paid by the property owner to the owner of the PV system; however, solar leases today can often offer electricity to the property owner for the same price or an even lower price than customers are currently paying for electricity from the grid.

- **Methodology:**
  - kW of PV installed
    - 2,658 owner-occupied homes in City. 2,658*25% (typical amount of homes suitable for solar)= 665 homes. Assume 50% (333 homes) install 6 kW = 1,998 kW residential solar installed[120]
  - Price of electricity

        - $0.125 per kWh[121]
    - Sun hours per day
        - 3[122]
    - Cost of PV installation
        - $1,215 per kW[123]

1,998	kW of PV Installed

$ 0.1250	Price of Electricity ($ per kWh)
3.0	Sun Hours per Day
$1,215	Cost of PV installation ($ per kW)
2,187,810	Annual Energy Production (kWh)
$273,476	Annual Cost Savings
9	Simple Payback (years) [xxii]

CO2e (metric tons)
497

Co-Benefits

-Renewable energy

-Local energy

-Produces no air pollutants

Preble Town Hall with 9 kW solar PV panels installed on roof

Success Stories

-9 kW installed on Town Hall building in Preble, expected to save 9,720 kWh annually.[124]

[xxii] Note: This calculation does not include maintenance costs.

3. Weatherization of Low-Income Housing

Strategy Description:
While low-income earners generally have smaller houses and fewer appliances than higher-income earners, their homes are often older and poorly insulated. Low-income weatherization programs seal cracks around windows and doors, add insulation, and sometimes replace inefficient appliances, reducing energy-use-related GHG emissions and lowering utility bills. There are federal and state programs to provide weatherization assistance (sometimes administered by local governments), but funding is limited and often insufficient for the number of homes requiring retrofitting. There is an opportunity for additional local programs to implement cost-effective energy saving measures that reduce emissions while benefiting low-income individuals and families.

The NYS Weatherization Assistance Program (WAP) assists income-eligible families and individuals by reducing their heating/cooling costs and improving the safety of their homes through energy efficiency measures. Energy efficiency measures performed through the program include air sealing (weatherstripping, caulking), wall and ceiling insulation, heating system improvements or replacement, efficiency improvements in lighting, hot water tank and pipe insulation, and refrigerator replacements with highly efficient Energy Star rated units. Both single-family and multi-family buildings are assisted. Household energy use reductions and resultant energy cost savings are significant, with an average savings in excess of 20%. Individual households apply by contacting the provider that serves their area. Households with incomes at or below 60% of state median income are eligible for assistance. Program services are available to both homeowners and renters, with priority given to senior citizens, families with children and persons with disabilities.

- **Methodology**
  - Number of homes retrofitted with loans
    - Assume 20% → Total occupied households = 4,479[125] * 20% = 896 homes
  - Price of electricity
    - $0.125 per kWh[126]
  - Price of fuel oil
    - $4.22[127]
  - Percentage of homes heated with gas
    - 3,134 homes using natural gas for heating of 4,479 total occupied homes[128] = 70%
  - Percentage of households using fuel oil
    - 355 homes using fuel oil for heating of 4,479 total occupied homes[129] = 7.9%
  - Average electric energy (kWh) used for heating per household
    - 18,904,127 kWh used for residential sector inside[130]* 60% for heating[131] = 11,342,476 kWh total for heating / 689 households using electricity for heat[132] = 16,462 kWh per household
  - Average natural gas energy (therms) used for heating per household

        - 2,006,581 therms total used for residential sector inside[133]* 60% for heating[134] = 1,203,949 therms total for heating / 3,134 households using natural gas for heat[135] = 384 therms per household
    - Typical household fuel oil use (gallons)
        - 16,647 MMBtu[136] total for fuel oil = 119,871 gallons fuel oil / 355 homes using fuel oil for heat[137] = 338 gallons per home
    - Percent savings for energy used for heating (electric, natural gas, and fuel oil) through weatherization program
        - 20% electricity, 32% natural gas, 32% fuel oil[138]
    - Weatherization program cost ($ per home)
        - An average of $4,900 to weatherize a single unit in September 2011[139]

896	Homes Weatherized

$ 0.1250	Price of Electricity ($ per kWh)
$ 1.30	Price of Natural Gas ($ per therm)
$4.22	Price of Fuel Oil ($ per gallon)
70	Percentage of Homes Heated with Gas
7.9	Percentage of Households Using Fuel Oil
16,462	Average Electrical Energy (kWh) Used for Heating per Household
384	Average Natural Gas Energy (Therms) Used for Heating per Household
338	Typical Household Fuel Oil Use (gallons)
20	Percent Savings of Energy Used for Heating (kWh)
32	Percent Savings of Energy Used for Heating (therms)
32	Percent Savings of Energy Used for Heating (Fuel Oil)
$4,900	Program Cost ($ per home)
651,948	Total Annual Electricity Savings (kWh)
77,070	Total Annual Natural Gas Savings (therms)
7,656	Total Annual Fuel Oil (gallons)
$239	Annual Cost Savings per Household
$213,993	Total Annual Cost Savings
21	Simple Payback (years)

CO2e (metric tons)
680

Co-Benefits		Success Stories
-Lower utility bills -Improving energy efficiency -Increase property values -Stimulate local economy through energy savings for low-income households		-Energy Star Home Performance Program: over 275,000 homes weatherized since 2002, lowering energy bills and improving comfort and indoor air quality.[140]

4. Geothermal Heat Pump

Strategy Description:
Geothermal heat pump technology utilizes the physical phenomenon of fairly constant annual temperatures several feet below the surface of the earth. During the winter, a heat exchanger fluid is pumped into the ground where the heat is transferred to the fluid and then delivered to the building as heat. During the summer, the heat exchanger fluid takes away the heat in the building and discharges it into the ground, thus cooling the building. Electricity is used to run the pumps for the geothermal system, meaning there will still be greenhouse gas emissions associated with heating and cooling unless the electricity is supplied by non-carbon sources; however, the energy use and emissions will be much less than with a traditional heating/cooling system. Because energy used for heating and cooling represents the majority of energy use in a building, installing a geothermal system can significantly reduce overall energy use and emissions.

- **Methodology:**
  - Number of homes using
    - 355 homes use fuel oil to heat,[141] assume 10% convert to geothermal = 36 homes
  - Price of electricity ($ per kWh)
    - $0.125 per kWh[142]
  - Price of fuel oil ($ per gallon)
    - $4.22 per gallon[143]
  - Annual oil use per house
    - 16,647 MMBtu[144] total for fuel oil = 119,871 gallons fuel oil / 355 homes using fuel oil for heat[145] = 338 gallons per home
  - Annual energy used for cooling (gallons of fuel oil)
    - 18,904,127 kWh used for residential sector inside[146] * 11% used for cooling[147] = 2,079,454 kWh / 4,479 households = 464 kWh
  - Square footage of average house = 2,437 sq. ft.[148]
  - Cost of geothermal heat pump system ($ per sq. ft.) = $4.82 / sq. ft. [149]

36	Number of Homes using

$0.1250	Price of Electricity ($ per kWh)
$4.22	Price of Oil ($ per gal)
338	Annual Oil Use Per House (gal)
80	Efficiency of Oil Boiler (%)
10,992	Annual Heat Demanded For Building (kWh conversion)
4	COP of Geothermal Heat Pump[150]
2,748	Annual Electricity Demanded For Heat With Geothermal (kWh)
464	Annual Cooling Electricity Use Per House (kWh)
10	EER Of Air Conditioning[151]
2.93	COP of Air Conditioning

1,360	Annual Heat Removed From Building (kWh conversion)
35	EER Of Geothermal Heat Pump
132.57	Annual Electricity Demanded for Cooling After Geothermal (kWh)
$4.82	Cost per Square Foot of Geothermal
2437	Square Footage of Average House
-86,996	Total Annual Electricity Savings (kWh)
12,168	Total Annual Oil Savings (gal)
$40,474	Annual Cost Savings
10.4	Simple Payback (years) [xxiii]

CO2e (metric tons)
140

- ***Notes**
  - Although total energy use is reduced significantly, electric energy usage would increase due to the drop off in fuel oil. However, solar and/or wind energy can be used to offset 100% of electricity used to run geothermal heat pumps, thus converting 100% of electricity used for heating to local renewable sources.
    - For a typical sized 10kW heat pump you would require at best 2.5kW of energy to run the heat pump. Depending on the heat distribution method or if domestic hot water is being produced it could be even higher (4kW+). To obtain this type of power you would require at least 25m2 of south facing roof covered in PV, (without the other household electricity consumption). If wind is being considered then, for example, a 5.5m diameter wind turbine at a height of 12m produces on average 11kWh per day. Enough to run the heat pump only for just under 3 hours.[152]
  - Geothermal systems may be eligible for low-interest financing through the Home Performance with Energy Star program[153]
  - New York State Energy Conservation Improvements Property Tax Exemption: includes solar PV, wind, and geothermal heat pumps- residents will receive exemptions for 100% of the value added to the residence by the improvements.[154]

Co-Benefits

-Reduce reliance on fossil fuels

-Decrease local air pollution

-Decrease energy costs

Geothermalgenius.org Banner

Success Stories

-The new net-zero Skaneateles Village Hall uses solar PV to capture energy from the sun, as well as geothermal heating and cooling, a geothermal water heater, Energy Star appliances, occupancy sensors, and Solatube light wells.[155]

[xxiii] Note: This calculation does not include maintenance costs.

5. LED Light Bulbs

Strategy Description:
LEDs (light emitting diodes) are between 40-50% more efficient than CFLs.[156] Replacing incandescent and compact fluorescent (CFL) bulbs with energy efficient LEDs reduces energy use, therefore reducing monthly utility bills and GHG emissions.

- **Methodology**
  - Number of Light bulbs replaced with LED's =
    - 4,479 homes, assume each home replaces 1 bulb with LED bulb
  - Hours of Operation = 3.12[157]
  - Price of Electricity ($ per kWh)= $0.125 per kWh[158]
  - Percent Compact Fluorescent Lamps = 50%
  - Percent Incandescent Lamps = 50%
  - Wattage of Compact Fluorescent Lamps = 13
  - Wattage of Incandescent Lamps = 60
  - $ per bulb = $9.97[159]

4,479	Light Bulbs Exchanged for LEDs

$ 0.1250	Price of Electricity ($ per kWh)
3.12	Hours of Operation
50	Percent CFL bulbs
50	Percent incandescent bulbs
13	Wattage of CFL bulb
60	Wattage of incandescent bulb
$9.97	Cost of LED bulb
93,086	Total Annual Energy Savings (kWh)
$11,636	Annual Cost Savings
$44,656	Implementation costs
3.8	Simple Payback (years)

CO2e (metric tons)
21

Co-Benefits

-Save on energy bills

-LEDs last much longer than incandescent or CFL bulbs

Success Stories

-Lighten Up Tompkins County- Cornell Cooperative Extension of Tompkins County distributed bags with free CFL bulbs, coupons, and

		energy-saving information to 5,000 homes to work towards reducing emissions by 20% by 2020.[160] A similar program could occur for LEDs. -San Diego and Scripps Institute of Oceanography offered free light bulbs and torchiere exchange and 2 for 1 admission to the aquarium for those who exchanged (CAPPA)[161]

6. Promote Loans/Incentives for Energy Efficiency Improvements

Strategy Description:
Many businesses and homes are not equipped with the most recent energy efficient technologies, causing the community to use more energy than is necessary. Retrofitting existing facilities through measures like replacing appliances with more efficient ones, increasing insulation, and upgrading HVAC systems can greatly improve energy efficiency and therefore reduce emissions. Local governments can encourage these efficiency improvements by offering low or zero interest loans to building owners for improvements. The Energy Improvement Corporation (EIC) was created in NYS to offer PACE (Property Assessed Clean Energy) financing to commercial customers in 2012. EIC is seeking municipalities with lean authority from throughout the state to adopt the PACE model and allow for commercial property owners to finance energy efficiency retrofits through their tax bill.

The City can also look into implementing a revolving loan fund in which homes receive loans for retrofits and pay back loans on their utility bill.

- **Methodology**
  - Number of homes retrofitted with loans
    - Assume 20% → Total occupied households = 4,479[162] * 20% = 896 homes
  - Price of electricity
    - $0.125 per kWh[163]
  - Price of fuel oil
    - $4.22[164]
  - Percentage of homes heated with gas
    - 3,134 homes using natural gas for heating of 4,479 total occupied homes[165] = 70%
  - Percentage of households using fuel oil
    - 355 homes using fuel oil for heating of 4,479 total occupied homes[166] = 7.9%
  - Average electric energy (kWh) used for heating per household
    - 18,904,127 kWh used for residential sector inside[167]* 60% for heating[168] = 11,342,476 kWh total for heating / 689 households using electricity for heat[169] = 16,462 kWh per household
  - Average natural gas energy (therms) used for heating per household
    - 2,006,581 therms total used for residential sector inside[170]* 60% for heating[171] = 1,203,949 therms total for heating / 3,134 households using natural gas for heat[172] = 384 therms per household
  - Typical household fuel oil use (gallons)
    - 16,647 MMBtu[173] total for fuel oil = 119,871 gallons fuel oil / 355 homes using fuel oil for heat[174] = 338 gallons per home
  - Percent savings for energy used for heating (electric, natural gas, and fuel oil) through retrofits
    - Use CAPPA estimates 10% for each

- Retrofit costs ($ per household)
  - In New York the average cost of projects ranges from $5,600 to $8,500[175]
  - Use average of $7,050 for CAPPA
  - NYSERDA offers a 10% cash back incentive when you complete energy efficiency upgrades through the Home Performance with ENERGY STAR program[176]
  - $7,050 * 10% = $705
  - $7,050 - $705 = $6,345

896	Homes Retrofitted with Loans

$ 0.1250	Price of Electricity ($ per kWh)
$ 1.30	Price of Natural Gas ($ per therm)
$ 4.22	Price of Fuel Oil ($ per gallon)
16,462	Typical Household Electricity Use (kWh)
384	Typical Household Natural Gas Use (therms)
338	Typical Household Fuel Oil Use (gallons)
70	Percentage of Households Using Natural Gas
8	Percentage of Households Using Fuel Oil
10	Percent Electricity Savings Compared to Existing Code
10	Percent Natural Gas Savings Compared to Existing Code
10	Percent Fuel Oil Savings Compared to Existing Code
$6,345	Retrofit Cost ($ per household)
325,974	Total Annual Electricity Savings (kWh)
24,084	Total Annual Natural Gas Savings (therms)
2,392	Total Annual Fuel Oil Savings (gallons)
$92	Cost Savings per Household
$82,153	Annual Cost Savings
69.2	Simple Payback (years)

CO2e (metric tons)
240

Co-Benefits		Success Stories
-Energy and water cost savings -Reduced criteria air pollutants by reducing energy use	NYSERDA New York State Energy Research and Development Authority	-NYSERDA Residential Loan Fund Program- offers loans up to 4% less than typical loans, up to $20,000.[177]

Commercial Energy Use

1. **Install Commercial Solar PV Panels**

Strategy Description:
Solar photovoltaic (PV) energy production harnesses the sun's energy to produce electricity. GHG emissions reductions from this strategy are equal to the emissions that would have been produced if the electricity was supplied through fossil fuel based sources by the local utility because electricity generated from PV systems displaces electricity demand which would ordinarily be supplied by the local utility. Contrary to popular belief solar power has been shown to be viable in a wide variety of climates that are not thought of as "sunny". Investments in solar energy should be combined with efficiency measures, with the shorter payback period of the efficiency measures helping to pay for the solar investment.

Many residents or businesses would like to use solar power, but the large up-front cost is an obstacle. Local governments can help overcome this barrier by paying a portion of system costs, offering low-interest loans, or organizing group buying programs to negotiate lower prices such as the Solarize Madison program in Madison County. These programs are an effective way of combining public and private funds for renewable energy. The New York State Energy Research and Development Authority (NYSERDA) provides incentives for the installation of Solar PV based on system size. Additionally there are state and federal tax credits for residential and commercial Solar PV installations. Educational and technical assistance programs can also promote solar power. Local governments can offer information clearinghouses and connect consumers with solar installers.

An increasingly popular way for businesses to overcome the financial hurdles of installing a photovoltaic system is through the "solar services model" also known as a Power Purchase Agreement (PPA). Through this type of arrangement the owner of a property can provide the space for a power producer to install the system. The property owner then agrees to buy the power produced from that system at a set rate that is competitive with grid electricity. Since the power producer retains ownership of the equipment, there are no installation and maintenance costs to the consumer of the electricity produced.

Similar to PPAs, residential and commercial property owners can take advantage of leasing agreements which will lower costs of implementing PV systems. Regional solar developers are currently offering lease products from companies like Sungevity and SunPower. These agreements allow property owners to install solar with no upfront cost. A monthly fee must be paid by the property owner to the owner of the PV system; however, solar leases today can often offer electricity to the property owner for the same price or an even lower price than customers are currently paying for electricity from the grid.

- **Methodology:**
  - kW of PV installed
    - Assume 1,700 kW[178]
  - Price of electricity

        - $0.10 per kWh[179]
    - Sun hours per day
        - 3[180]
    - Cost of PV installation
        - $1,500 per kW[181]

1,700	kW of PV Installed

$0.10	Price of Electricity ($ per kWh)
3.0	Sun Hours per Day
$1,500	Cost of PV installation ($ per kW)
1,861,500	Annual Energy Production (kWh)
$186,150	Annual Cost Savings
14	Simple Payback (years) [xxiv]

CO2e (metric tons)
423

Co-Benefits

-Renewable energy

-Local energy

-Produces no air pollutants

Preble Town Hall with 9 kW solar PV panels installed on roof

Success Stories

-9 kW installed on Town Hall building in Preble, expected to save 9,720 kWh annually.[182]

[xxiv] Note: This calculation does not include maintenance costs.

2. Promote Energy Efficiency through Campaign Targeted at Businesses

Strategy Description:
Educational programs targeted at businesses can provide information to business owners about energy saving measures they can take in their businesses, such as replacing appliances with energy efficient ones, sealing leaks and increasing insulation, or turning the thermostat down in cold weather and up in hot weather. These types of educational programs can reduce energy use significantly, therefore reducing GHG emissions.

- **Methodology:**
  - Number of businesses participating in education
    - 1,355 total commercial establishments in Madison County in 2010[183]
    - Madison county population = 73,442[184]; City of Oneida population = 11,393[185] = 15.51% of Madison County's total population
    - 1,355 *15.51% = 210 businesses
    - Assume 10% participate
    - 210 * 10% = 21 businesses
  - Price of electricity
    - $0.10 per kWh[186]
  - Price of natural gas
    - $0.77 per therm[187]
  - Annual energy savings per business (kWh) due to education program
    - Use CAPPA info/source – 11,500 kWh
  - Annual energy savings per business
    - 367 therms natural gas (CAPPA estimate)
  - Cost of education program ($ per business)
    - Use CAPPA estimate - $1,000

21	Businesses Participating

$0.10	Price of Electricity ($ per kWh)
$0.77	Price of Natural Gas ($ per therm)
11,500	Annual Energy Savings per Business (kWh)
367	Annual Energy Savings per Business (gallons Fuel Oil)
$1,000	Cost of Education Program ($ per business)
241,500	Total Annual Energy Savings (kWh)
7,707	Total Annual Energy Savings (gallons fuel oil)
$30,084	Annual Cost Savings
0.7	Simple Payback (years)

CO2e (metric tons)
98

Co-Benefits

-Reductions in energy bills

-Increased comfort in buildings

Success Stories

-Energy Star's Portfolio Manager tool helps commercial buildings track and assess energy and water consumption in existing buildings, identify the best opportunities for improvement, track immediate and cost effective reductions over time and document savings results.[188]

-Flex Your Power (California)- Recognizes businesses showing leadership in energy efficiency and provides information on available incentives and best practices by industry.[189]

3. Install Lighting Occupancy Sensors

Strategy Description:
Lighting is typically the largest electricity draw in commercial buildings. Energy is wasted by lights that are left on when no one is using them. Installation of lighting occupancy sensors prevents waste by using sensors to detect motion in the lighted space and turning lights off if no one is present. Sensors can reduce energy use for lighting by an average of 35%.

Sensors are usually either ultrasonic or infrared. If no motion is detected after a set delay period, the sensor turns off or dims lights. Occupancy sensors are a low-cost way to save energy on lighting, with a typical payback time of less than two years. This strategy is usually included when completing an energy-efficiency retrofit to an existing facility; however, occupancy sensors can also be implemented at a separate time or in buildings that do not undergo complete energy-efficiency retrofits, and this strategy is therefore included as a separate measure.

- **Methodology:**
  - Square feet installed with occupancy sensors
    - 23,911 total nonfarm workers in Madison County in 2010[190]
    - Total commercial square feet in Madison County = 5.4 square feet per worker[191] * 23,911 = 129,119 square feet
    - Madison county population = 73,442[192]; City Oneida population = 11,393[193] = 15.51% of Madison County's total population
    - 129,119 * 15.51% = 20,026 commercial square feet in City
    - Assume half install sensors = about 10,000 square feet
  - Price of electricity ($ per kWh)
    - $0.10 per kWh[194]
  - Annual lighting energy use per square foot (kWh)
    - 6.85 (CAPPA estimate)
  - Percent savings with occupancy sensors
    - 35% (CAPPA estimate)
  - Cost of sensors ($ per square foot)
    - $0.06 (CAPPA estimate)

10,000	Square Feet Installed with Occupancy Sensors

$ 0.1000	Price of Electricity ($ per kWh)
6.85	Annual Lighting Energy Use per Square Foot (kWh)
35	Percent Savings With Occupancy Sensors
$0.06	Cost of Sensors ($ per square foot)
23,975	Total Annual Electricity Savings (kWh)
$2,398	Annual Cost Savings
0.2	Simple Payback (years)

CO2e (metric

tons)
5

Co-Benefits

- Security provided by motion sensor lighting

- Work automatically once installed

A typical lighting occupancy sensor

Success Stories

- DeWitt Town Hall installed light sensors in bathrooms, supply rooms, and other rooms where lights might normally be left on.[195]

4. Institute a Power-Down at Night Policy

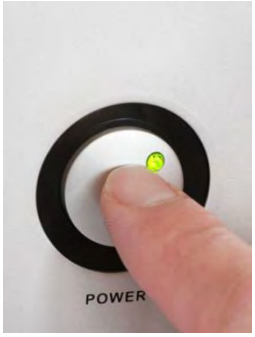
Strategy Description:
Many buildings waste a significant amount of energy when lights and other electronics are left on at night when they are not in use. Creating a policy of turning lights and other electronics off throughout buildings at the end of the work day reduces electricity wasted during non-business hours, therefore reducing GHG emissions from buildings and facilities. Lighting is typically the largest electricity user in commercial buildings. A power down at night policy can use a combination of education and technology like timers, power strips, and motion sensors.

- **Methodology:**
  - Square feet with power-down at night policy
    - 23,911 total nonfarm workers in Madison County in 2010[196]
    - Total commercial square feet in Madison County = 5.4 square feet per worker[197] * 23,911 = 129,119 square feet
    - Madison county population = 73,442[198]; City Oneida population = 11,393[199] = 15.51% of Madison County's total population
    - 129,119 * 15.51% = 20,026 commercial square feet in City
    - Assume half participates = about 10,000 square feet
  - Price of electricity ($ per kWh)
    - $0.10 per kWh[200]
  - Annual lighting energy use per square foot (kWh)
    - 6.85 (CAPPA estimate)
  - Percent savings with policy
    - 35% (CAPPA estimate)
  - Cost of sensors ($ per square foot)
    - $0.06 (CAPPA estimate)

10,000	Square Feet with Power-Down at Night Policy

$ 0.10	Price of Electricity ($ per kWh)
6.85	Annual Lighting Energy Use per Square Foot (kWh)
35	Percent Savings With Policy
$0.06	Cost of Implementation ($ per square foot)
23,975	Total Annual Electricity Savings (kWh)
$2,398	Annual Cost Savings
0.2	Simple Payback (years)

CO2e (metric tons)
5

Co-Benefits	Success Stories
-Reduces light pollution -Reduces energy bill  	- NYSERDA estimates that power management (turning off underused office equipment or adjusting thermostats, upgrading to energy-efficient equipment, and encouraging changes in employee behavior) can reduce plug load by 40-60%, which would mean a statewide emissions reduction of more than 57,000 tons of CO_2 every year and significant savings on local government energy bills.[201] - Buffalo, NY - A project team found that low-cost/no-cost measures could reduce city government's power consumption by 595,060 kWh annually, saving an estimated $71,000. Measures for city hall include turning off copiers and printers after hours; shortening the period of inactivity before copiers go into "sleep mode" during business hours; reminding staff to shut down personal computers, monitors, and other plug-load equipment during extended daytime absences; replacing inefficient appliances with ENERGY STAR® models; specifying an upcoming new copier lease bid to ensure energy efficient models installed and properly configured.[202] - In 2009, Dunwoody, Georgia implemented a successful “power down” policy, aimed at reducing energy use while buildings are not in use. The municipality found that in order to successfully require businesses and citizens to participate, an ordinance must be constructed.[203]

5. Energy Efficiency Retrofits of Existing Facilities

Strategy Description:
Many of the City's buildings are not equipped with the most recent energy efficient technologies, causing community members to use more energy than is necessary. Retrofitting existing facilities through measures like replacing appliances with more efficient ones, increasing insulation, and upgrading HVAC systems can greatly improve energy efficiency and therefore reduce emissions from commercial buildings and facilities.

Local governments can encourage these efficiency improvements by offering low or zero interest loans to building owners for improvements. The Energy Improvement Corporation (EIC) was created in NYS to offer PACE (Property Assessed Clean Energy) financing to commercial customers in 2012. EIC is seeking municipalities with lean authority from throughout the state to adopt the PACE model and allow for commercial property owners to finance energy efficiency retrofits through their tax bill.

The City can encourage businesses to retrofit their facilities and/or use cleaner energy by providing incentives, such as providing cheaper energy in the business park. The City can also review their codes/zoning regulations to allow for energy efficiency improvements/efficient new construction projects to be more easily implemented.

- **Methodology:**
  - Square feet of facilities retrofitted
    - 23,911 total nonfarm workers in Madison County in 2010[204]
    - Total commercial square feet in Madison County = 5.4 square feet per worker[205] * 23,911 = 129,119 square feet
    - Madison county population = 73,442[206]; City Oneida population = 11,393[207] = 15.51% of Madison County's total population
    - 129,119 * 15.51% = 20,026 commercial square feet in City
    - Assume 20% retrofit
    - 20,026 *20%= 4,005, assume 4,000 square feet
  - Price of electricity
    - $0.10 per kWh[208]
  - Price of natural gas
    - $0.77 per therm[209]
  - Typical new construction annual energy use per square foot (kWh)
    - 12.5[210]
  - Typical new construction annual energy use per square foot (therms)
    - 0.452[211]
  - Percent electricity savings
    - Assume 25%[212]
  - Percent natural gas savings
    - Assume 25%[213]
  - Retrofit cost ($ per square foot)

- Assume $5[xxv]

Community

4,000	Square Foot of Facilities Retrofitted

Community

$ 0.100	Price of Electricity ($ per kWh)
$ 0.77	Price of Natural Gas ($ per therm)
12.5	Typical New Construction Annual Energy Use per Square Foot (kWh)
0.45	Typical New Construction Annual Energy Use per Square Foot (therms)
25	Percent Electricity Savings
25	Percent Natural Gas Savings
$5.00	Retrofit Cost ($ per square foot)
12,500	Total Annual Electricity Savings (kWh)
450	Total Annual Natural Gas Savings (therms)
$1,597	Annual Cost Savings
12.5	Simple Payback (years)

Community

CO2e (metric tons)
5

Co-Benefits

-Reductions in energy bills

-Increased comfort in buildings

Success Stories

- The Energy Improvement Corporation (EIC) was created in NYS to offer PACE (Property Assessed Clean Energy) financing to commercial customers in 2012. EIC is seeking municipalities with lean authority from throughout the state to adopt the PACE model and allow for commercial property owners to finance energy efficiency retrofits through their tax bill.[214]

[xxv] Chris Carrick, CNY RPDB. It is important to note that retrofit costs vary widely depending on the age of the building being retrofitted and the measures being implemented.

Waste

1. Encourage Organics (Kitchen) Composting

Strategy Description:
When organic matter like wood, paper, food, and yard wastes is placed in landfills, it decomposes anaerobically, producing methane. Methane is a greenhouse gas 21 times as powerful as carbon dioxide. Collecting and composting organic waste prevents the emissions it would have produced in the landfill.

Composting produces fertilizer that can be used for farms or gardens, returning nutrients to the soil that were removed with food production. Composting reduces the volume of material sent to landfills, reducing disposal costs.

- **Methodology**
  - Waste diverted from landfill (lbs/person/year)
    - Food waste = 18.6% total waste[215]
    - Total waste per person = 0.64 tons[216]
    - 1 ton = 2,000 lbs.
    - Therefore, total waste per person = 0.64*2,000 = 1,280 lbs. annually
    - 1,280 lbs.*18.6%= 238 lbs. food waste per person
    - Assume 25% is composted. 238 lbs.*25% = 60 lbs. per person
  - Village population
    - 11,393[217]

60	Waste Diverted from Landfill (lbs/person/yr)

11,393	Village Population
54	Life Cycle Emissions Avoided due to Composting (metric tons CO2e)
2	Annual Methane Emission Avoided from Food Waste (metric tons CO2e)
-1,030-	Change in kWh Generated from Energy Recovery

CO2e (metric tons)
2*

*Note: the emissions reductions for organics composting in the City of Oneida is insignificant due to the landfill gas collection and energy recovery systems used by Madison County Landfill.

Co-Benefits

-Composting creates fertilizer that can be used for farming or gardens instead of fertilizers derived from fossil fuels

-Reduced cost in fertilizers

-Reduced amount of waste treated in landfills

Amboy Compost Site Aerated Static Pile System

Success Stories

-Amboy Compost Site (Camillus, NY) has effectively composted yard and food waste for several years.[218]

-San Francisco's Mandatory Recycling and Composting Ordinance requires residents to separate their recyclables, compostables, and landfill trash. They hope to produce zero waste by 2020. (CAPPA source)[219]

2. Encourage Yard Waste Composting

Strategy Description:
When organic matter like wood, paper, food, and yard wastes is placed in landfills, it decomposes anaerobically, producing methane. Methane is a greenhouse gas 21 times as powerful as carbon dioxide. Collecting and composting organic waste prevents the emissions it would have produced in the landfill.

Composting produces fertilizer that can be used for farms or gardens, returning nutrients to the soil that were removed with food production. Composting reduces the volume of material sent to landfills, reducing disposal costs.

- **Methodology**
  - Waste diverted from landfill (lbs/person/year)
    - Grass, Leaves, Branches = 7.1% total waste[220]
    - Total waste per person = 0.64 tons[221]
    - 1 ton = 2,000 lbs.
    - Therefore, total waste per person = 0.64*2,000 = 1,280 lbs. annually
    - 1,280 lbs.*7.1%= 91 lbs. yard waste per person
    - Assume 25% is composted. 91 lbs.*25% = 23 lbs. per person
  - City population
    - 11,393[222]

23	Waste Diverted from Landfill (lbs/person/yr)

11,393	City Population
-70	Life Cycle Emissions Avoided due to Composting (metric tons CO2e)
0	Annual Methane Emission Avoided from Food Waste (metric tons CO2e)
-213	Change in kWh Generated from Energy Recovery

CO2e (metric tons)
0.38*

*Note: the emissions reductions for yard waste composting in the City of Oneida is insignificant due to the landfill gas collection and energy recovery systems used by Madison County Landfill.

Co-Benefits

-Composting creates fertilizer that can be used for farming or gardens instead of fertilizers derived from fossil fuels

-Reduced cost in fertilizers

-Reduced amount of waste treated in landfills

Amboy Compost Site Aerated Static Pile System

Success Stories

-Amboy Compost Site (Camillus, NY) has effectively composted yard and food waste for several years.[223]

-San Francisco's Mandatory Recycling and Composting Ordinance requires residents to separate their recyclables, compostables, and landfill trash. They hope to produce zero waste by 2020. (CAPPA source)[224]

Natural Resources

1. Tree Planting for Carbon Storage and Energy Savings

Strategy Description:
Planting trees in strategic ways to shade buildings can reduce energy used to cool buildings. Trees that are properly planted with energy savings in mind can reduce the amount of energy (electricity, natural gas, or other fuel) used to cool and heat buildings. This not only reduces associated emissions, but also saves money. The shade from a single well-placed mature tree reduces annual air conditioning use from two to eight percent (in the range of 40-300 kWh), and peak cooling demand from two to ten percent (as much as 0.15-0.5 kW) therefore reducing GHG emissions.

The City of Oneida has already been designated a *Tree City* by the National Arbor Day Foundation. This means that the City meets the following four criteria: maintaining a tree board or department, having a community tree ordinance, spending at least $2 per capita on urban forestry and celebrating Arbor Day.[225] The City also plans to plant more street trees in the downtown area. Community members can follow the lead of the local government by planting trees at their homes or businesses.

- **Methodology**
  - Number of trees planted
    - Total occupied households = 4,479[226]
    - Assume 20% households plant 1 tree = 4,479 * 20% = 896
  - Price of electricity
    - $0.125 per kWh[227]
  - Annual energy savings of one mature tree (kWh)
    - An average tree conserves 435–483 kWh of electricity over 25 years post planting[228]
    - Avg. of 435 and 483 = 459 kWh over 25 years
    - 459 / 25 = 18.36 kWh per tree per year
  - Annual CO_2 absorbed by one mature tree (metric tons)
    - A single mature tree can absorb carbon dioxide at a rate of 48 lbs./year[229]
    - 1 pound = 0.00045359237 metric tons[230]
    - Annual CO_2 absorbed by one mature tree = .02177243376 metric tons
    - ~ .022 metric tons
  - Cost of planting a tree (depends on the tree planted)
    - $12 maple tree[231]
    - $12 paper birch
    - $9 cedar tree
    - $10.50 hickory
      - Avg. of $10.88 per tree

896	Trees Planted to Shade Buildings

$ 0.1250	Price of Electricity ($ per kWh)
18	Annual Energy Savings of one Mature Tree (kWh)
.022	Annual CO2 Absorbed by one Mature Tree (metric tons)
$11	Cost of Planting Tree
16,451	Total Annual Energy Savings (kWh)
$2,056	Annual Cost Savings
5	Simple Payback (years)

CO2e (metric tons)
201

Co-Benefits

-Save on energy bills

-Can reduce storm water runoff

-Can create more attractive environment, increasing property values

A well shaded home, according to the Arbor Day Foundation website.

Success Stories

-The Arbor Day Foundation provides information on its website explaining how to plant trees to conserve energy most effectively.[232]

Reduction Summaries

Municipal Operations:

	Strategy Name	Implementation Level	Emissions Reductions ($MTCO_2e$)	Annual Cost Savings	Estimated Payback (years)
1	Energy efficiency retrofits to existing buildings	98,415 square feet (half government buildings)	193	$64,197	7.7
2	Install solar PV	500 kW	124	$66,795	8
3	Conversion to hybrid vehicles	10 vehicles (of 13 passenger vehicles)	80	$27,981	0.7
4	Lighting occupancy sensors	98,415 square feet (half government buildings)	54	$28,786	0.2
5	LED Streetlights*	(824 NG-Owned lights)	(38)	($44,994)	(uncertain)
6	Conversion to electric vehicles	3 vehicles (of 13 passenger vehicles)	34	$11,916	1.3
7	Police on bicycles	2 bicycle officers	23	$13,600	0.2
8	Reflective roofing	30,000 square feet (roof of Kallet and City Hall)	8	$3,124	1
9	Remove City-owned ornamental streetlights	86 City-owned lights removed	8	$9,392	uncertain
10	Power-Down at Night policy	7,520 square feet (office space in City Hall, Justice Center, and Armory)	4	$2,200	0.2
11	Improve water pumping energy efficiency	20% energy efficiency improvements	2	$1,340	7.5

*Investigated converting NG-owned lights to LEDs even though the option is currently not available. Figures for City-owned lighting conversions ONLY are included in charts/graphs and final reduction potential figures.

Total potential municipal operations reductions: **530 $MTCO_2e$; 22.5%** from GHG inventory baseline

Community:

	Strategy Name	Implementation Level	Emissions Reductions ($MTCO_2e$)	Annual Cost Savings	Estimated Payback (years)
1	Expand bicycling infrastructure	Converting 25% of trips 2 miles or less from car to biking	4,812	$1,819,911	0.06 (10 mi. paths at $10,000 per mile and 20 sharrows at $229 each)
2	Conversion to hybrid vehicles	15% community vehicles	1,755	$663,873	2.8
3	Increase telecommuting	5% of Oneida residents	1,536	$580,944	0

	Strategy Name	Implementation Level	Emissions Reductions ($MTCO_2e$)	Annual Cost Savings	Estimated Payback (years)
4	Expand pedestrian infrastructure	5% trips less than 1 mile switching from car to walking	1,435	$542,759	0.04 years (Assuming 10 pedestrian signals are installed and 10 additional miles of sidewalk are plowed per snowfall, assuming 90 snowfalls)
5	Weatherization of homes	20% occupied households (896 homes)	680	$213,993	21
6	Conversion to electric vehicles	5% community vehicles	642	$242,643	3.7
7	Energy efficiency education: residents	10% occupied households (448 homes)	572	$189,544	0 (depends on actions residents take)
8	Residential solar PV	1,998 kW (25% of owner-occupied homes suitable for solar, assuming 50% install 6kW system)	497	$273,476	9
9	Commercial solar PV	1,700 kW	423	$186,150	14
10	Promote carpooling/vanpooling	15% of people with jobs outside of City offered carpool opportunities with a 10% reduction in commute vehicle trips	364	$137,523	0
11	Promote loans/incentives for energy improvements	20% occupied homes	240	$82,153	69.2
12	Tree planting for carbon storage/energy savings	896 trees (20% households plant 1 tree)	201	$2,056	5
13	Geothermal heat pump	10% of homes using fuel oil convert (36 homes)	140	$40,474	10.4
14	Energy efficiency education: businesses	10% businesses in City (210 businesses)	98	$30,084	0.7
15	Electric vehicle charging facilities	5	24	$9,121	35.6
16	Conversion to LED bulbs	1 bulb per household	21	$11,636	3.8
17	Increase bus ridership	10% increase in riders (4 more riders per day)	12	$4,479	Immediate (assuming no cost to implement)
18	Lighting occupancy sensors	10,000 square feet	5	$2,398	0.2
19	Power-Down at Night	10,000 square feet	5	$2,398	0.2
20	Retrofits to commercial buildings	4,000 square feet	5	$1,597	12.5
21	Organics (kitchen) composting	60 lbs. (25% food waste generated per person)	2	-	-
22	Yard waste composting	23 lbs. (25% yard waste generated per person)	0.4	-	-

Total potential community reductions: **13,469 $MTCO_2e$; 12.6%** from GHG inventory baseline

CAFE Standards Emissions Reduction Calculations

Description: New Federal CAFE Standards
The U.S. Congress first enacted Corporate Average Fuel Economy (CAFE) standards in 1975 to reduce energy consumption by increasing the fuel economy of cars and light trucks. In 2011 the United States Environmental Protection Agency (US EPA) and The National Highway Traffic Safety Administration (NHTSA) established new fuel efficiency standards for passenger vehicles to average 34.1 miles per gallon by 2016. NHTSA issued finalized standards for model years 2017 – 2025 in 2012 that will increase fuel economy to the equivalent of 54.5 mpg for cars and light-duty trucks. It is anticipation that U.S. oil consumption with decrease by 12 billion barrels by 2025, saving more than $1.7 trillion dollars.[233] These changes at the national level will impact vehicle-based emissions within the Village, as such the analysis team has attempted to identify the potential impacts of improved fuel economy. The NHTSA has also mandated improvements in medium and heavy-duty vehicle fuel efficiencies; however, we do not have enough information at this time to calculate the emissions reductions that will occur due to these standards.

- **Methodology:**
  - CAPPA tab "Use Smaller Fleet Vehicles"
    - Average mpg 2016 = 34.1
    - Average mpg 2025 = 54.5

- Government: 2016
  - Americans keep cars an average of 11.4 years[234], so assume by 2016 half of the municipal gasoline-powered vehicles have been changed over since the 2011 inventory.
  - 41 gasoline-powered vehicles in City[235]

20	Number of Smaller Vehicles Used

$3.30	Price of Gasoline ($ per gallon)[236]
34.1	Small Vehicle Miles per Gallon
13.5	Miles per Gallon of Vehicle Replaced[237xxvi]
11,029	Average Annual Miles per Vehicle[238xxvii]
9,871	Annual Gasoline Savings (gallons)
$32,573	Annual Cost Savings

[xxvi] For gasoline-powered vehicles
[xxvii] For gasoline-powered vehicles

CO2e (metric tons)
93

- Government: 2025

21	Number of Smaller Vehicles Used

$3.30	Price of Gasoline ($ per gallon) [239]
54.5	Small Vehicle Miles per Gallon
13.5	Miles per Gallon of Vehicle Replaced
11,029	Average Annual Miles per Vehicle
12,907	Annual Gasoline Savings (gallons)
$42,592	Annual Cost Savings

CO2e (metric tons)
121

- Community: 2016
  - Americans keep cars an average of 11.4 years[240], so assume by 2016 half of the Village's passenger vehicles have been changed over since the 2011 inventory.
  - AVMT= 90,351,031.843 miles[241]
  - Assume 1/3 miles are through traffic (do not begin or end in City of Oneida) = 90,351,031.843 *(2/3) = 60,234,021
  - 60,234,021- 523,288 miles total gov VMT[242] = 59,710,733
  - 59,710,733 / 6,485 total community vehicles = 9,208 average annual miles per vehicle

3,242	Number of Smaller Vehicles Used[243]

$3.56	Price of Gasoline ($ per gallon)[244]
34.1	Small Vehicle Miles per Gallon
23.5	Miles per Gallon of Vehicle Replaced[245]
9,208	Average Annual Miles per Vehicle
394,877	Annual Gasoline Savings (gallons)
$1,405,762	Annual Cost Savings

CO2e (metric tons)
3,717

- Community: 2025
  - Assume the other half of community vehicles are converted by 2025.

4,243	Number of Smaller Vehicles Used[246]

$3.56	Price of Gasoline ($ per gallon)[247]
54.5	Small Vehicle Miles per Gallon
23.5	Miles per Gallon of Vehicle Replaced[248]
9,208	Average Annual Miles per Vehicle
722,563	Annual Gasoline Savings (gallons)
$2,572,324	Annual Cost Savings

CO2e (metric tons)
6,801

[1] 2013 Municipal vehicle fleet information provided by Jon Rauscher, City Engineer. See "Municipal vehicle fleet summary AS" spreadsheet for more information.
[2] 2013_Fuel Usage workbook provided by Jon Rauscher, City Engineer
[3] 2013 Municipal vehicle fleet information provided by Jon Rauscher, City Engineer. See "Municipal vehicle fleet summary AS" spreadsheet for more information.
[4] 2013 Municipal vehicle fleet information provided by Jon Rauscher, City Engineer. See "Municipal vehicle fleet summary AS" spreadsheet for more information.
[5] http://www.consumerenergycenter.org/transportation/hybrids/
[6] Kelly Blue Book
[7] http://www.dec.ny.gov/energy/57108.html
[8] http://www.dec.ny.gov/energy/57108.html
[9] http://www.greenhoustontx.gov/ev/index.html
[10] 2013 Municipal vehicle fleet information provided by Jon Rauscher, City Engineer. See "Municipal vehicle fleet summary AS" spreadsheet for more information.
[11] 2013_Fuel Usage workbook provided by Jon Rauscher, City Engineer
[12] 2013 energy use data provided by Jon Rauscher, City Engineer
[13] 2013 Municipal vehicle fleet information provided by Jon Rauscher, City Engineer. See "Municipal vehicle fleet summary AS" spreadsheet for more information.
[14] 2013 Municipal vehicle fleet information provided by Jon Rauscher, City Engineer. See "Municipal vehicle fleet summary AS" spreadsheet for more information.
[15] http://www.governor.ny.gov/press/04112013-hundreds-of-electric-vehicle-charging-stations
[16] http://cleantechnica.com/2012/11/11/the-most-successful-electric-car-cities-infographic/

[17] http://www.goelectricdrive.com/index.php/news-events/item/83-available-incentives-for-electric-vehicles
[18] 2013_Fuel Usage workbook provided by Jon Rauscher, City Engineer
[19] 2013 Municipal vehicle fleet information provided by Jon Rauscher, City Engineer. See "Municipal vehicle fleet summary AS" spreadsheet for more information.
[20] 2013 Municipal vehicle fleet information provided by Jon Rauscher, City Engineer. See "Municipal vehicle fleet summary AS" spreadsheet for more information.
[21] CAPPA estimate
[22] CAPPA estimate
[23] http://www.lafayette.in.gov/egov/docs/1208273925577.htm
[24] 2013 energy use data provided by Jon Rauscher, City Engineer
[25] 2013 energy use data provided by Jon Rauscher, City Engineer
[26] 2013 energy use data provided by Jon Rauscher, City Engineer
[27] 2013 energy use data provided by Jon Rauscher, City Engineer
[28] http://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/use-portfolio-manager?c=evaluate_performance.bus_portfoliomanager
[29] http://www.dec.ny.gov/energy/64095.html
[30] 2013 energy use data provided by Jon Rauscher, City Engineer
[31] http://nyserda.cleanpowerestimator.com/nyserda.htm.There is a 1218 multiplicative factor between kW installed and annual kWh output (calculated from the results of the NYSERDA Clean Power estimator, which when divided by 365 days per year, is the equivalent of 3.34 capturable sun hours per day. Assuming 10% losses in the equipment, this drops the deliverable sun hours per day to 3.0.
[32] Chris Carrick, CNY RPDB. This is the price at which it would make sense for local governments to install solar. Otherwise, payback periods may be too long and municipal operations may want to focus their attention on projects with shorter payback periods.
[33] c2ip_programadministration_2012_Revised_no_cayuga_CC_5-24-13 excel sheet saved in CNY RPDB Y drive
[34] 2013 energy use data provided by Jon Rauscher, City Engineer
[35] Town of DeWitt. 2012. Local Government and Community Greenhouse Gas Emissions Inventory and Analysis:2008 Baseline
[36] http://www.daftlogic.com/projects-google-maps-area-calculator-tool.htm
[37] 2013 energy use data provided by Jon Rauscher, City Engineer
[38] 2013 energy use data provided by Jon Rauscher, City Engineer
[39] Environmental Protection Agency. 2008. Reducing Urban Heat Islands: Compendium of Strategies. http://www.epa.gov/heatisld/resources/compendium.htm
epa roof
[40] According to Jon Rauscher, City Engineer
[41] 2013 energy use data provided by Jon Rauscher, City Engineer
[42] http://www.dec.ny.gov/energy/64089.html
[43] http://www.dec.ny.gov/energy/64095.html
[44] www.dunwoodyga.com/Libraries/Sustainability
[45] Information is based on a discussion on 10/2/13 with National Grid employees David Hess and Christopher Gorman.
[46]Streetlight data provided by Jon Rauscher, City Engineer
[47] Streetlight data provided by Jon Rauscher, City Engineer
[48] Streetlight data provided by Jon Rauscher, City Engineer
[49] Streetlight data provided by Jon Rauscher, City Engineer
[50] Streetlight data provided by Jon Rauscher, City Engineer
[51] Streetlight data provided by Jon Rauscher, City Engineer
[52] http://villageofsolvay.com/wp-content/uploads/2010/02/08-21-12-regular-brd-mtg.pdf
[53] 2010 census
[54] 2013 energy use data provided by Jon Rauscher, City Engineer
[55] http://www.oneidacity.com/Waterletter.pdf
[56] City of Oneida Water Department 2011 Annual Report, p. A3: http://www.ci.oneida.ny.us/Departments/Water/anualreportwater.pdf
[57] CAPPA example: http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0CEQQFjAA&url=http%3A%2F%2Fwww.discoverrensselaer.com%2FLibraries%2FRCWSA_Public_Documents%2FAnnual_Report_-_2011_02_08_12.sflb.ashx&ei=HJ2DUqjHMav84AOeq4DgDg&usg=AFQjCNGb6AZiqLOr4rFIsdYo2h73-8kRVQ&bvm=bv.56343320,d.dmg
[58] 2013 VMT calculated by Amanda Sopchak. See City of Oneida data collection workbook for more information.
[59] http://blog.bikeleague.org/blog/2010/01/national-household-travel-survey-short-trips-analysis/

[60] http://www.gaspricewatch.com/NY-new-york/Oneida/gas-prices/page-1/2.htm; average price for Oneida, NY on 2/19/14
[61] http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_statistics/html/table_04_23.html
[62] http://www.destinyusa.com/index.php?page=green
[63] http://www.aarp.org/livable-communities/learn/transportation-mobility/info-2013/federal-investment-in-bicycling-10-success-stories.html
[64] http://onthemap.ces.census.gov/ → City of Oneida, jobs by distance
[65] According to http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_12_5YR_S2403 , 134 workers work in the information job sector and 158 workers work in the finance/insurance job sector, or about 5% of the workforce in Oneida.
[66] http://www.gaspricewatch.com/NY-new-york/Oneida/gas-prices/page-1/2.htm; average price for Oneida, NY on 2/19/14
[67] CAPPA estimate
[68] http://onthemap.ces.census.gov/ → City of Oneida, jobs by distance
[69] http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_statistics/html/table_04_23.html
[70] www.teleworkarizona.com/mainfiles/visitor/voverview.htm
[71] http://www.gaspricewatch.com/NY-new-york/Oneida/gas-prices/page-1/2.htm; average price for Oneida, NY on 2/19/14
[72] National Grid Upstate NY Average
[73] http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_statistics/html/table_04_23.html
[74] Visions CNY Regional Sustainability Plan p. 106
[75] Visions CNY Regional Sustainability Plan p. 107
[76] http://www.governor.ny.gov/press/04112013-hundreds-of-electric-vehicle-charging-stations
[77] http://www.afdc.energy.gov/cleancities/coalition/central-new-york video
[78] http://www.greenhoustontx.gov/ev/houstondriveselectric.html
[79] 2010 Census
[80] http://www.gaspricewatch.com/NY-new-york/Oneida/gas-prices/page-1/2.htm; average price for Oneida, NY on 2/19/14
[81] National Grid Upstate NY Average
[82] http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_statistics/html/table_04_23.html
[83] 2013 VMT calculated by Amanda Sopchak. See City of Oneida data collection workbook for more information.
[84] 2013 Municipal vehicle fleet information provided by Jon Rauscher, City Engineer. See "Municipal vehicle fleet summary AS" spreadsheet for more information.
[85] http://www.governor.ny.gov/press/04112013-hundreds-of-electric-vehicle-charging-stations
[86] http://cleantechnica.com/2012/11/11/the-most-successful-electric-car-cities-infographic/
[87] http://www.goelectricdrive.com/index.php/news-events/item/83-available-incentives-for-electric-vehicles
[88] 2013 VMT calculated by Amanda Sopchak. See City of Oneida data collection workbook for more information.
[89] http://blog.bikeleague.org/blog/2010/01/national-household-travel-survey-short-trips-analysis/
[90] http://www.gaspricewatch.com/NY-new-york/Oneida/gas-prices/page-1/2.htm; average price for Oneida, NY on 2/19/14
[91] http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_statistics/html/table_04_23.html
[92] http://www.destinyusa.com/index.php?page=green
[93] 2010 Census
[94] http://www.gaspricewatch.com/NY-new-york/Oneida/gas-prices/page-1/2.htm; average price for Oneida, NY on 2/19/14
[95] http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_statistics/html/table_04_23.html
[96] 2013 VMT calculated by Amanda Sopchak. See City of Oneida data collection workbook for more information.
[97] 2013 Municipal vehicle fleet information provided by Jon Rauscher, City Engineer. See "Municipal vehicle fleet summary AS" spreadsheet for more information.
[98] http://www.consumerenergycenter.org/transportation/hybrids/
[99] Kelly Blue Book
[100] http://www.dec.ny.gov/energy/57108.html
[101] http://www.dec.ny.gov/energy/57108.html
[102] http://www.greenhoustontx.gov/ev/index.html
[103] According to Scott Ingmire, Madison County, the City of Oneida averages 43 rides per day. Buses hold 16 passengers and up to two wheel chairs.
[104] http://www.gaspricewatch.com/NY-new-york/Oneida/gas-prices/page-1/2.htm; average price for Oneida, NY on 2/19/14
[105] http://onthemap.ces.census.gov/ → City of Cortland, jobs by distance
[106] http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_statistics/html/table_04_23.html
[107] http://bloomington.in.gov/documents/viewDocument.php?document_id=6502
[108] http://bloomington.in.gov/media/media/image/png/14653.png
[109] http://www.gaspricewatch.com/NY-new-york/Oneida/gas-prices/page-1/2.htm; average price for Oneida, NY on 2/19/14
[110] http://onthemap.ces.census.gov/ → City of Cortland, jobs by distance
[111] http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_statistics/html/table_04_23.html

[112] http://www.ogs.ny.gov/BU/BA/parking/Employee/Carpool.asp
[113] 2010 census
[114] National Grid Upstate NY Average
[115] Chris Carrick, CNY RPDB
[116] 2010 National Grid energy data in GHG inventory
[117] 2010 National Grid energy data in GHG inventory
[118] According to the Energy Challenge Team program info
[119] According to the Energy Challenge Team program info
[120] 2010 census, Chris Carrick, CNY RPDB
[121] National Grid Upstate NY Average
[122] http://nyserda.cleanpowerestimator.com/nyserda.htm.There is a 1218 multiplicative factor between kW installed and annual kWh output (calculated from the results of the NYSERDA Clean Power estimator, which when divided by 365 days per year, is the equivalent of 3.34 capturable sun hours per day. Assuming 10% losses in the equipment, this drops the deliverable sun hours per day to 3.0.
[123] Scott Ingmire- Solarize Madison 2013 information, assuming a NYSERDA rebate of $1 per Watt for the first 50 kW installed, a 30% federal tax credit and a 25% state tax credit. http://www.nyserda.ny.gov/Energy-Efficiency-and-Renewable-Programs/Renewables/Solar-Technologies/PV-Funding-Balance.aspx
[124] c2ip_programadministration_2012_Revised_no_cayuga_CC_5-24-13 excel sheet saved in CNY RPDB Y drive
[125] 2010 census
[126] National Grid Upstate NY Average
[127] https://www.nyserda.ny.gov/Energy-Data-and-Prices-Planning-and-Policy/Energy-Prices-Data-and-Reports/Energy-Prices/Home-Heating-Oil/Average-Home-Heating-Oil-Prices.aspx
[128] 2010 census
[129] 2010 census
[130] 2011 National Grid data from GHG inventory
[131] http://cmsapps.nyserda.ny.gov/homeheating/Tips.html
[132] 2010 census
[133] 2011 National Grid data from GHG inventory
[134] http://cmsapps.nyserda.ny.gov/homeheating/Tips.html
[135] 2010 census
[136] 2011 energy data in GHG inventory, see "Village of Cazenovia data collection workbook" for more details
[137] 2010 census
[138] CAPPA estimates
[139] http://oversight.house.gov/wp-content/uploads/2012/04/Corrected-Weatherization-Report-Final-2.pdf p.8
[140] http://www.energystar.gov/index.cfm?fuseaction=hpwes_profiles.showsplash
[141] 2010 census
[142] National Grid Upstate NY Average
[143] https://www.nyserda.ny.gov/Energy-Data-and-Prices-Planning-and-Policy/Energy-Prices-Data-and-Reports/Energy-Prices/Home-Heating-Oil/Average-Home-Heating-Oil-Prices.aspx
[144] 2011 energy data in GHG inventory, see "Village of Cazenovia data collection workbook" for more details
[145] 2010 census
[146] 2011 National Grid data from GHG inventory
[147] http://www.slideshare.net/SamuelGordon/energy-challenge-teamoutreachpresentation
[148] Energy Information Administration. 2009. Residential Energy Consumption Survey (RECS): Average heated square footage for detached oil fueled houses in New York
[149] Price based on geothermal system installed by Alan Cohen, Oneida City resident and member of advisory committee. Price includes 30% federal tax credit.
[150] Environmental Protection Agency. 2013. ENERGY STAR Most Efficient 2013 — Geothermal Heat Pumps. http://www.energystar.gov/index.cfm?c=most_efficient.me_geothermal_heat_pumps COP of 4 is a typical number.
[151] Power Knot, LLC. 2009-2013. COPs, EERs, and SEERs: How Efficient is Your Air Conditioning System? http://www.powerknot.com/how-efficient-is-your-air-conditioning-system.html
[152] http://www.yougen.co.uk/blog-entry/1675/Three+things+to+consider+before+running+a+heat+pumps+with+solar+or+wind+power/
[153] http://www.nyserda.ny.gov/BusinessAreas/Energy-Efficiency-and-Renewable-Programs/Renewables/Geothermal-Heat-Pumps.aspx
[154] http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=NY27F&re=1&ee=1
[155] http://sustainableskaneateles.wordpress.com/events-programs/alternative-energy-tour-saturday-october-5-noon-4-pm/skaneateles-village-hall/
[156] http://eartheasy.com/live_energyeff_lighting.htm

[157] According to the EIA tables, 13.35% of electricity consumption in Northeast America is from lighting, 13.35% of 24 hours=3.12 hours
[158] National Grid Upstate NY Average
[159] Home Depot Cree 60W equivalent Soft White Dimmable LED Light Bulb
[160] http://ccetompkins.org/energy/lighten-tompkins
[161] https://scripps.ucsd.edu/news/2473
[162] 2010 census
[163] National Grid Upstate NY Average
[164] https://www.nyserda.ny.gov/Energy-Data-and-Prices-Planning-and-Policy/Energy-Prices-Data-and-Reports/Energy-Prices/Home-Heating-Oil/Average-Home-Heating-Oil-Prices.aspx
[165] 2010 census
[166] 2010 census
[167] 2011 National Grid data from GHG inventory
[168] http://cmsapps.nyserda.ny.gov/homeheating/Tips.html
[169] 2010 census
[170] 2011 National Grid data from GHG inventory
[171] http://cmsapps.nyserda.ny.gov/homeheating/Tips.html
[172] 2010 census
[173] 2011 energy data in GHG inventory, see "Village of Cazenovia data collection workbook" for more details
[174] 2010 census
[175] http://www.energystar.gov/ia/home_improvement/HPwES_Utility_Intro_FactSheet.pdf
[176] http://www.nyserda.ny.gov/Energy-Efficiency-and-Renewable-Programs/Residential/Programs/Existing-Home-Renovations/How-the-Process-Works/Incentives-and-Financing.aspx
[177] http://www.nyserda.ny.gov/BusinessAreas/Energy-Efficiency-and-Renewable-Programs/Residential/Programs/Existing-Home-Renovations/Residential-Loan-Fund-Program.aspx
[178] The roofs of various buildings were analyzed to achieve this figure as well, including the Post Office (8,255 square feet), Hospital (79,024 square feet), Library (2,044 square feet south facing), market at Onieda Commons (12,743 square feet), All State building (23,489 square feet), Movieplex Cinemas/Subway/Planet Fitness building on Glenwood Ave (224,346 square feet), and HP Hood (175,556 square feet), and Oneida High School (122,635 square feet) assuming 1 kW system requires about 400 square feet of roof space, http://www.potentiasolar.com/faq.html and using http://www.daftlogic.com/projects-google-maps-area-calculator-tool.htm. WalMart is also planning to install a solar PV array.
[179] Assume similar to 2013 city hall price - $0.10 (energy data provided by Jon Rauscher, City Engineer)
[180] http://nyserda.cleanpowerestimator.com/nyserda.htm.There is a 1218 multiplicative factor between kW installed and annual kWh output (calculated from the results of the NYSERDA Clean Power estimator, which when divided by 365 days per year, is the equivalent of 3.34 capturable sun hours per day. Assuming 10% losses in the equipment, this drops the deliverable sun hours per day to 3.0.
[181] Chris Carrick, CNY RPDB
[182] c2ip_programadministration_2012_Revised_no_cayuga_CC_5-24-13 excel sheet saved in CNY RPDB Y drive
[183] http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=BP_2010_00A1
[184] 2010 Census
[185] 2010 Census
[186] Assume similar to 2013 city hall price - $0.10 (energy data provided by Jon Rauscher, City Engineer)
[187] Assume similar to 2013 city hall price - $0.77 (energy data provided by Jon Rauscher, City Engineer)
[188] http://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/use-portfolio-manager?c=evaluate_performance.bus_portfoliomanager
[189] http://www.fypower.org/com/
[190] NYS Department of Labor http://lehd.ces.census.gov/applications/qwi_online/
[191] CBECS Table B1: http://www.eia.gov/consumption/commercial/data/2003/pdf/b1rse-b46rse.pdf
[192] 2010 Census
[193] 2010 Census
[194] Assume similar to 2013 city hall price - $0.10 (energy data provided by Jon Rauscher, City Engineer)
[195] Town of DeWitt. 2012. Local Government and Community Greenhouse Gas Emissions Inventory and Analysis:2008 Baseline
[196] NYS Department of Labor http://lehd.ces.census.gov/applications/qwi_online/
[197] CBECS Table B1: http://www.eia.gov/consumption/commercial/data/2003/pdf/b1rse-b46rse.pdf
[198] 2010 Census
[199] 2010 Census
[200] Assume similar to 2013 city hall price - $0.10 (energy data provided by Jon Rauscher, City Engineer)
[201] http://www.dec.ny.gov/energy/64089.html

[202] http://www.dec.ny.gov/energy/64095.html
[203] www.dunwoodyga.com/Libraries/Sustainability
[204] NYS Department of Labor http://lehd.ces.census.gov/applications/qwi_online/
[205] CBECS Table B1: http://www.eia.gov/consumption/commercial/data/2003/pdf/b1rse-b46rse.pdf
[206] 2010 Census
[207] 2010 Census
[208] Assume similar to 2013 city hall price - $0.10 (energy data provided by Jon Rauscher, City Engineer)
[209] Assume similar to 2013 city hall price - $0.77 (energy data provided by Jon Rauscher, City Engineer)
[210] Energy Information Administration. 2003. Commercial Building Energy Consumption Survey (CBECS). End Use Consmumption Tables for All Buildings. http://www.eia.gov/consumption/commercial/data/2003/index.cfm?view=consumption#e1a
[211] Energy Information Administration. 2003. Commercial Building Energy Consumption Survey (CBECS). End Use Consmumption Tables for All Buildings. http://www.eia.gov/consumption/commercial/data/2003/index.cfm?view=consumption#e1a
[212] www.eetd.lbl.gov/news/article/48634/savings-70-percent-or-more-of-energy-use
[213] www.eetd.lbl.gov/news/article/48634/savings-70-percent-or-more-of-energy-use
[214] http://pacenow.org/about-pace/commercial-pace-programs/
[215] ICLEI Solid Waste Emission Activities, Appendix E, p. 32
[216] Madison County Landfill 2010 annual report
[217] 2010 census
[218] https://ocrra.org/news/details/38
[219] http://www.sfenvironment.org/zero-waste/recycling-and-composting?ssi=3&ti=6
[220] ICLEI Solid Waste Emission Activities, Appendix E, p. 32
[221] Madison County Landfill 2010 annual report
[222] 2010 census
[223] https://ocrra.org/news/details/38
[224] http://www.sfenvironment.org/zero-waste/recycling-and-composting?ssi=3&ti=6
[225] http://arborday.org/programs/treeCityUSA/about.cfm
[226] 2010 census
[227] National Grid Upstate NY Average
[228] http://actrees.org/news/trees-in-the-news/research/mature-trees-significantly-reduce-energy-use-in-urban-areas/
[229] http://chemistry.about.com/od/environmentalchemistry/f/oxygen-produced-by-trees.htm
[230] Google Calculator (google search)
[231] http://www.arborday.org/shopping/trees/treedetail.cfm?ID=28
[232] http://www.arborday.org/globalwarming/summerShade.cfm
[233] Press Release: National Highway Transportation Safety Administration. Obama Administration Finalizes Historic 54.5 mpg Fuel Efficiency Standards. August 28, 2012 http://www.nhtsa.gov/About+NHTSA/Press+Releases/2012/Obama+Administration+Finalizes+Historic+54.5+mpg+Fuel+Efficiency+Standards
[234] http://www.huffingtonpost.com/reno-charlton/american-drivers-keeping-_b_3718301.html
[235] 2013 Municipal vehicle fleet information provided by Jon Rauscher, City Engineer. See "Municipal vehicle fleet summary AS" spreadsheet for more information.
[236] 2013_Fuel Usage workbook provided by Jon Rauscher, City Engineer
[237] 2013 Municipal vehicle fleet information provided by Jon Rauscher, City Engineer. See "Municipal vehicle fleet summary AS" spreadsheet for more information.
[238] 2013 Municipal vehicle fleet information provided by Jon Rauscher, City Engineer. See "Municipal vehicle fleet summary AS" spreadsheet for more information.
[239] 2013_Fuel Usage workbook provided by Jon Rauscher, City Engineer
[240] http://www.huffingtonpost.com/reno-charlton/american-drivers-keeping-_b_3718301.html
[241] 2013 VMT calculated by Amanda Sopchak. See City of Oneida data collection workbook for more information.
[242] 2013 Municipal vehicle fleet information provided by Jon Rauscher, City Engineer. See "Municipal vehicle fleet summary AS" spreadsheet for more information.
[243] 6,485 total community vehicles (2010 census) *50% = 3,242.5
[244] http://www.gaspricewatch.com/NY-new-york/Oneida/gas-prices/page-1/2.htm; average price for Oneida, NY on 2/19/14
[245] http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_statistics/html/table_04_23.html
[246] 6,485 total community vehicles*50% = 3,242.5
[247] http://www.gaspricewatch.com/NY-new-york/Oneida/gas-prices/page-1/2.htm; average price for Oneida, NY on 2/19/14
[248] http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_statistics/html/table_04_23.html